COMMEMORATIVE ALBUM

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INDIAN
INSTITUTE
भिन्नेष्वैक्यस्य दर्शनम्
UNITY IN DIVERSITY

INDIAN STATISTICAL INSTITUTE

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FOREWORD

Seventy five years ago, on 17th December, Professor Prasanta Chandra Mahalanobis established the Indian Statistical Institute as a learned society, initially at the Presidency College and later shifted it to the present premises at Baranagar in Kolkata, to promote research in the theory and applications of statistics as a new scientific discipline in India. Mahalanobis, and his associates and successors, relentlessly nurtured with care and patience this sapling which has now grown into an imposing banyan tree, very much like the one which is the Institute emblem, a haven for bright and talented academics working in a number of disciplines. Over the decades, the Institute has grown steadily and, at present, boasts of seven scientific divisions at Kolkata, a Branch in Giridih, two Centres in Delhi and Bangalore, and a network of Statistical Quality Control and Operations Research units at Baroda, Mumbai, Pune, Coimbatore, Chennai and Hyderabad.

Various scientists and dignitaries have visited the Institute, from time to time, whose contributions and combined efforts have steered our Institute to the position it now enjoys in the academic world.

The present album provides a collection of selective rare photographs witnessing different benchmark events of the Institute over the period of 75 years. Some of the significant achievements of the Institute accomplished through research and teaching are explicated, which will give the substantive background for the photographs.

The members of the Album preparation committee (Prof. Atis Dasgupta, Dr. Usha Mujoo Munshi, Smt. Krishna Bhattacharya and Shri Tapas Basu) have done an excellent job in bringing out this *Platinum Jubilee Commemorative Album*, particularly within a short span of time.

December 07, 2006
Kolkata

Sankar K. Pal
Director

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The members of the Committee, formed by the Director of ISI for preparation of the Platinum Jubilee Commemorative Album, would like to record their gratitude for the kindness and cooperation received from the following colleagues of the Institute: Professor B.V. Rao, Professor S.B. Rao, Professor Bikas K. Sinha, Professor Rajkumar Roy Choudhuri, Professor Dipankar Coondoo, Professor Bhargab B. Bhattacharya, Professor Sujit Majumder, Professor Dilip Saha, Professor Ranjan Gupta, Professor Anup Majumdar, Professor Tapas Samanta, Professor Ayanendra Nath Basu, Professor Samarendra Bhattacharya, Professor Debapriya Sengupta, Professor Prabal Dasgupta, Dr. Snigdha Chakraborti, Dr. Barun Mukhopadhyay, Dr. Anjali Ghosh, Dr. Nibedita Ganguly, Dr. Rabindra Nath Jana, Dr. Sushmita Bharati, Sm. Subhasree Ganguli, Shri Amar Kr. Paul, Shri Sarajit Roy, Shri Pushpal Kundu, Shri Subrata Paul and Shri Partha Pratim Halder.

Professor Sankar K. Pal, Director of ISI, and Professor Deb Kumar Bose have given their advice, whenever sought for. Professor Manjula Chatterjee, Shri Chitta R. Bhattacharyya and Professor Samir Guha Roy also extended their kind cooperation to the Committee.

Illumination of 'Amrapali' building on the eve of Platinum Jubilee celebration of the Institute

INDIAN STATISTICAL INSTITUTE :
A JOURNEY THROUGH THE LAST 75 YEARS

1. FOUNDATION

The Platinum Jubilee celebration of Indian Statistical Institute (or ISI) will begin from 17th December 2006. On the same day 75 years ago, Professor Prasanta Chandra Mahalanobis founded the Institute, initially at the Presidency College (Calcutta) and thereafter shifted it to the present premises at Baranagar in Calcutta, to usher in research in the theory and applications of statistics as a new scientific discipline in India. The ISI was soon registered as a learned society on 28th April 1932, with the headquarters at Calcutta. We would seek to delineate the landmarks of the phenomenal process through which Professor P.C. Mahalanobis and his able associates had relentlessly nurtured the sapling which has now grown to be a banyan tree and earned a central stage in the world of research and training in statistics and the related sciences — the banyan tree which also stands out as the ISI's symbol with a philosophical motto of 'unity in diversity'. Over the decades, the Institute has flanked out by setting up seven scientific divisions at the headquarters, along with two Centres in Delhi and Bangalore, a Branch in Giridih, a network of units of Statistical Quality Control and Operations Research at Baroda, Mumbai, Pune, Coimbatore, Chennai and Hyderabad, and a station at Takdah in Darjeeling.

2. BASIC PHILOSOPHY

The philosophy of 'unity in diversity' has an enduring significance in the context of the unifying role of statistics in relation to the growth of several research units in various sciences which were subsequently grouped under seven scientific divisions in ISI. From the inception, Professor Mahalanobis and Sir Ronald Fisher perceived statistics to be "a key technology", representing inseparable relation between its theory and practice. Mahalanobis encouraged in ISI a relentless interaction of statistics with various other sciences — social, biological, earth & physical, and computer & communication — in order to explore the twin aspects of statistics — its general applicability to other disciplines which involve experimentation, measurement and inference from sample to aggregate as well as reliance of statistics on other disciplines for its own development. He also emphasized that, in a developing country like India, it was essential to make statistics purposive "to help in solving scientific or practical problems" of the society.

3. EARLY PHASE

- Within few years of the foundation of ISI, Professor Mahalanobis's achievements in the application of statistics in solving the urgent problems of the country, which included innovative projects on sample surveys on estimation of yield and land utilization of crops, socio-economic after-effects of the Bengal famine, and problems of flood control, were highly acclaimed. As regards his significant contributions to statistical theory and methods, particular mention should be made of his D^2 statistic known as Mahalanobis generalized distance, his concepts of pilot surveys, interpenetrating network of sub-samples, optimal design of a sample survey, along with his other major achievements. His pioneering works inspired a large number of bright Indian students to take up statistics as a career and the Institute made fundamental contributions to theoretical statistics, theory of sample surveys, probability theory, experimental design and its applications to the industry.

- The symbiotic relationship between statistics and other sciences began to be reflected in Sankhyā, the Indian Journal of Statistics, which came to be regularly published by the Institute and carried much of the pioneering research work of Professor Mahalanobis and his close associates, like Professor R.C. Bose, Professor S.N. Roy and Professor C.R. Rao. After independence of the country, Professor Mahalanobis was appointed, in 1949, Honorary Statistical Adviser to the Central Cabinet, Government of India. In 1950, the National Sample Survey (NSS) was initiated in ISI for conducting socio-economic surveys of all-India coverage for the first time in the country. Soon after, he helped the formation of Central Statistical Organization (CSO) to provide the Government of India with a sound statistical system, along with a chain of State Statistical Bureaus in different provinces of the country. In 1954, Prime Minister Jawaharlal Nehru entrusted Professor Mahalanobis and ISI with the responsibility of preparation of the draft Second Five-Year Plan for the country. The draft submitted by Mahalanobis and the planning models formulated by him have since been regarded as major contributions to economic planning in India.

- Teaching in the Institute took shape since 1939 in response to the research needs of ISI in order to equip the students and trainees with the knowledge for applying statistical methods in different scientific disciplines. This interdisciplinary thrust of teaching was more systematically organized during 1950s through the active guidance of Professor P.C. Mahalanobis, Sir Ronald Fisher and Professor J.B.S. Haldane, with the encouragement of Professor Satyendra Nath Bose and the support of Shri C.D. Deshmukh. Mahalanobis formulated that "it is the policy of the Institute to establish small, high-level research units in both the natural and social sciences to offer facilities for training and research in the use of statistical methods in practice. The point has to be emphasized that it is only in the advancing form of genuine research that new types of data would be thrown up offering scope for the extension of known methods or as a challenge for forging new tools." He continued. "In our Institute we have always pursued a policy closely integrating research, training and project work."

- Adhering to the course of inter-disciplinary research, major strides were wade in computer science since the early 1950s. The Electronic Computer Laboratory was established in ISI in 1950. The first electronic computer in India, a HEC-2M, was installed in the Institute in 1956. In 1961, ISI, in collaboration with Jadavpur University, undertook the design, development and fabrication of a fully transistorized digital computer, called ISIJU-1, which was commissioned in 1966. The foremost formal course in computer science of the country was introduced in the Institute in 1963.

- In the early 1950s, ISI initiated the use of Statistical Quality Control and Operation Research (SQC & OR) in India by organizing a visit of Professor W.A. Shewhart in 1948 and later by inviting other eminent experts like Dr. W.E. Deming and Dr. Genichi Taguchi. The SQC promotional work gradually began to spread all over the industrial centres in India under a comprehensive programme covering education and training, applied research and consultancy services.
- In 1950, the International Statistical Education Centre (ISEC) was established in ISI in order to impart training in statistical science to the participants from the developing countries of Asia and Africa. ISEC came to be run by ISI in collaboration with the International Statistical Institute under the auspices of UNESCO and Government of India.

4. CELEBRATION OF THE SILVER JUBILEE OF ISI

- Shri C. D. Deshmukh, President of the Institute, inaugurated the Silver Jubilee celebration at a meeting in Calcutta on 17th December 1956. During his speech, he read out the following message received from the Prime Minister, Pandit Jawaharlal Nehru: "The Indian Statistical Institute has gained a reputation for itself not only in India but in every country where statistics are studied. It has grown in recent years and has performed important functions in connection with our planning work. Indeed, it is an essential part now of our planning organization. On the occasion of its Silver Jubilee, I send it all my good wishes".
- Professor Mahalanobis, in his speech, explicated : "We have continually pressed on Government the need of giving the Institute full freedom and autonomy in internal management. We are a non-government but public institution; and, so far, we have tried to discharge our public responsibilities not as a Government department but as an independent institution. I am myself convinced that this is desirable not so much in the interest of the Institute itself but of the country as a whole. In fact, converting the Institute into a Government department would relive us of much worry, because things will go on somehow, but there would be the danger of losing the initiative. Therefore, I think it is important in the best interests of the country that we should continue to function as an independent public institution. I am glad to say this has been accepted in principle, and we are hoping that fairly soon it would be recognized through Parliamentary action. ...We must remember that in an under-developed country... like India statistics must have a clearly defined purpose, one aspect of which is scientific advance and the other, human welfare and national development...Therefore, we must never lose the initiative". Sir Ronald A. Fisher and Professor Frank Yates, along with the other dignitaries, participated in the meeting.
- During the Silver Jubilee celebration, a series of lectures and symposia were organized in two groups: 56 lectures were organized under the auspices of the Institute, while two international symposia were held at the initiative of ISEC.

5. ENACTMENT OF THE ISI ACT

The remarkable achievements of the Institute, under the leadership of Professor Mahalanobis, in theoretical and applied statistical work, motivated the Government of India to recognize ISI as an 'institution of national importance' by the enactment of the ISI Act of the Parliament, which was steered by Pandit Jawaharlal Nehru in 1959. Thereafter the Government of India began to extend almost total financial assistance to the Plan and non-Plan activities of ISI along with the concomitant reciprocity of accountability on the part of the Institute. In the process, it was ensured that the basic autonomous character of ISI as a learned society, registered under the West Bengal Societies' Registration Act, would remain undisturbed.

6. EMPOWERMENT TO AWARD DEGREES

- After the enactment of the ISI Act (1959), the Institute was empowered to award degrees and diplomas. The already existing teaching programmes were consolidated and expanded. The courses leading to the degrees of Bachelor of Statistics [B.Stat. (Honours)] and Master of Statistics (M.Stat) as well as Ph.D programmes were introduced in June 1960. Later on, the courses leading to Master of Technology degrees in Computer Science [M.Tech (CS)] and in Quality, Reliability and Operations Research [M.Tech (QR & OR)] were ushered in. These programmes have been eminently successful in turning out well-trained students, many of whom have subsequently attained international reputation. The ISI Act of 1959 was amended by the Parliament in September 1995 to empower the Institute to award degrees/diplomas, in addition to statistics, in mathematics, quantitative economics, computer science and in such other subjects related to statistics as may be determined by the Institute from time to time. Following this amendment, certain new courses have been introduced in ISI such as Master of Science degree in Quantitative Economics [M.S (QE)] in 1996, followed by B.Math (Honours) degree, and M. Math degree.
- Special Awards, Medals, and Prizes are systematically given to the talented students and the young promising scientists of the Institute for their excellence in different scientific fields, such as, Haldane Memorial Prize, Mahalanobis International Symposium on Statistics Prize, TCS Awards, the ISI Alumni Association Prizes, Mrs M.R. Iyer Memorial Medals, the ISI Alumni Association Rashi Ray Memorial Medal, Sunity Kumar Pal Gold Medal, S.H. Aravind Gold Medal, Raja Rao Memorial Prize, and M.N. Murthy Memorial Prize.

7. DISTINGUISHED VISITORS

- From its formative period, the Institute received as guests eminent scientists and well-known statesmen from abroad. Since 1939, Sir Ronald A. Fisher was a frequent visitor to ISI and, as requested by Professor Mahalanobis, helped the shaping of some of the emerging scientific activities of the Institute, while in 1957 Professor J.B.S. Haldane started working as a member of the scientific staff of ISI. Other eminent scientists, some of whom were Noble Laureates, had also visited the Institute during this period. These luminaries included Frederic and Irene Julio Curie, Neils Bohr, Frank Yates, A.N. Kolmogorov, PMS Blackett, Jerzy Neyman, Norbert Wiener, J.D. Bernal, Harold Hotelling, Oscar Lange, Joan Robinson, Charles Bettelheim, Jan Tinbergen, Nicholas Kaldor, Simon Kuznets, and Ragner Frisch. In recent times, the visit of Professor Amartya K. Sen in January 2001, soon after he became a Noble Laureate, and the Convocation Address by Professor Lotfi A. Zadeh (in February 2006) may be specially mentioned.

- Professor Mahalanobis was perhaps the only Indian scientist who was equally welcome in the USA and USSR as well as in China and Japan during the Cold War period in 1950s and 60s. Chou-en-Lai, the then Prime Minister of China, came to ISI and invited Professor Mahalanobis to improve the official statistical system in China. Ho Chi Minh, Che Guevara, and Alexei Kosygin had also visited the Institute. On the other hand, Lyndon Johnson, the then Vice-President of USA, accompanied by Professor Galbraith, interacted with Professor Mahalanobis. Pandit Jawaharlal Nehru, the first Prime Minister of India, visited the Institute on several occasions, particularly in the context of the formulation of the draft Second Five-Year Plan of the country. In 1962, he received the D.Sc. Degree *honoris causa* from ISI. Three other Premiers of India — Shrimati Indira Gandhi, Shri Morarji Desai, and Shri P.V. Narasimha Rao — came to ISI. Dr. A.P.J. Abdul Kalam, President of India, visited the Institute and delivered his Convocation Address in February 2004.

8. NATIONAL AND INTERNATIONAL HONOURS AND AWARDS

The Institute always nourished in its scientific staff several well-known statisticians, mathematicians, computer scientists, economists and scientists from other sciences. They included Fellows of The Royal Society, London, Fellows of the American Statistical Association, Fellows of the Indian National Science Academy, Fellows of the Indian Academy of Science, Fellows of the Econometric Society, recipients of the S.S. Bhatnagar Prize, Fellows of IEEE, Fellows of Third World Academy of Science, and Fellows of other scientific societies in India and abroad. Professor P.C. Mahalanobis, followed by Professor C.R. Rao and Professor J.K. Ghosh, held the prestigious position of President of International Statistical Institute.

9. DEMISE OF PROFESSOR MAHALANOBIS

Professor Mahalanobis was the founder Director of ISI since its inception and remained in the pivotal position for four decades, in spite of his several other important assignments in India and abroad. He passed away at Kolkata on 28th June 1972. Professor C.R. Rao, one of the ablest successors of Professor Mahalanobis, became the next Director of ISI and continued to carry on the legacy till his retirement in 1976. The demise of Professor Mahalanobis was a major set back for the Institute. At the same time, two decisions of the Government of India also produced serious repercussions on the functioning of ISI. One was the delinking of the Institute from the Perspective Planning Division of the Planning Commission, while the other was the separation of National Sample Survey from ISI in 1972. As a consequence of these events, the systematic involvement of the Institute with the wider problems of national development processes began to be less vibrant. However, ISI sought to strike a judicious balance between the individual academic work on truly fundamental problems and the work that called for a greater engagement with the social and economic problems facing the country.

10. CONTINUATION AND DEEPENING OF THE MAHALANOBIS TRADITION

In the critical juncture caused by the demise of Professor Mahalanobis, the role of Shri P.N. Haksar as the Chairman of the ISI Council, from 1973 till his death in 1998, turned out to be rejuvenating for the Institute, particularly in organizational matters at the appropriate levels. Shri Haksar, who was formerly Principal Advisor to the Prime Minister of India, took care to maintain proper relationship with the Government of India in tune with the ISI Act of the Parliament, while, at the same time, upholding the basic autonomous character of ISI as a learned society. He, ably supported by Professor C.R. Rao and other senior scientists like Professor B.P. Adhikari, expedited the process of amending the Memorandum and the Regulations of the Institute in 1974, which were implemented in 1976, making them more systematic, democratic and accountable. Shri Haksar and the next Chairpersons of the ISI Council (Dr. Bimal Jalan, Professor N.R. Madhava Menon and Shri Pranab Mukherjee), along with the successive Directors of ISI (i.e. Professors C.R. Rao, G. Kallianpur, B.P. Adhikari, Ashok Maitra, J.K. Ghosh, B.L.S. Prakasa Rao, S.B. Rao, K.B. Sinha, and Sankar K. Pal), have given a collective leadership to the scientists of the Institute and provided them with the optimum ambience to reach new heights in inter-disciplinary research. This recovery was achieved by situating Professor Malanobis's basic perception of statistics as a key technology, responding to new academic possibilities. These refreshing possibilities tended to emerge from the research work of various science units which, originally located within the erstwhile Research and Training School (RTS) of the Institute, were now distributed, following the amended Regulations since 1976, across the newly created seven scientific divisions — (i) Theoretical Statistics & Mathematics, (ii) Applied Statistics, (iii) Social Sciences, (iv) Biological Sciences, (v) Physics and Earth Sciences, (vi) Computer and Communication Sciences, and (vii) Statistical Quality Control & Operations Research. For each scientific division, the landmarks of the efflorescence of the Mahalanobis tradition would be explicated hereafter.

11. EMERGING RESEARCH AREAS FROM THE SCIENTIFIC DIVISIONS: THE TURNING POINTS

11.1 Theoretical Statistics & Mathematics Division

- The Division of Theoretical Statistics and Mathematics (known as Stat-Math Division) of ISI was created in July 1976 as a part of the implementation process of the amended Regulations of the Institute. It originated from the erstwhile Research & Training School (RTS) of ISI, located at the headquarters in Kolkata. The RTS was the nucleus of the research and teaching activities of the Institute since 1949 till the middle of 1976. As advised by Professor Mahalanobis who remained the Director and the Secretary of the whole Institute from December 1931 till his demise in June 1972, Professor C.R. Rao led the RTS as its Director from its inception in 1949. Professor Rao held this pivotal position till his retirement which almost coincided with the implementation of the amended Regulations of the Institute in July 1976.

- The process of building up a theoretical school in statistics, probability and mathematics began when several talented young scholars joined the Indian Statistical Institute to form an active theoretical research group in statistics under the guidance of Professor P. C. Mahalanobis. The theoretical research in these areas soon became an integral part of the activities of RTS. The list of eminent scholars during the initial period included personalities like R. C. Bose, S. N. Roy, K. R. Nair and C. R. Rao, followed by I. M. Chakravarti, D. K. Roy Choudhuri and others. They pioneered new areas of theoretical research to both complement and supplement the type of activities the Institute was involved in for its funding and expansion as well. These activities were encouraged by Professor Mahalanobis and brought the highest degree of international acclaim for the Institute. These researchers made fundamental contributions to design of experiments, combinatorics, coding theory, multivariate analysis, theory of estimation and statistical inference, large sample theory, higher-order statistical efficiency, orthogonal arrays and differential geometry. The results like Rao-Blackwell theorem and Cramer-Rao information inequality have found applications in almost all areas where statistics is applied today.
- The research activities in the mathematical statistics and probability theory began in the mid-fifties, contributing to an understanding of the concept of independence and its elegant applications in problems of statistical inference. These results are now known collectively as Basu's theorems. The original problems came out of an attempt to examine the Fisherian theory of inference rigorously. Sir Ronald A. Fisher himself used to interact with the group of researchers of RTS with great interest at that time.
- Subsequently, a firm foundation for the probability activities was laid by the quartet, V. S. Varadarajan, R. Ranga Rao, K. R. Parthasarathy, and S. R. S. Varadhan — known as the Indian School of Probability. The results obtained on the weak convergence of probabilities on metric spaces and limit theorems in Hilbert spaces are now part of the standard theory. So are the structure theory of infinitely divisible distributions on locally compact Abelian groups and Bahadur-Ranga Rao large deviation results. Study on Ergodic theory was also taken up during this period.
- During the mid-sixties, there was intensive activity in Dynamic Programming and Stochastic games lead by Ashok Maitra. Most of the results centered around getting near optimal strategies. Functions of finite Markov Chains were also intensively studied. Professor Maitra was also instrumental in creating interest in new research areas such as descriptive set theory and logic, selection theorems and classical topology among young researchers of that time. The Division remained strong in these areas of research for several years. Around the same time C. R. Rao and S. K. Mitra made extensive study on g-inverses in the context of linear statistical models. J. K. Ghosh made fundamental contributions in understanding of sufficiency and invariance in statistical inference.

- During the late sixties and seventies, the activities in statistics and probability progressed in diverse fronts. Main contributions in statistics included the study of second order efficiency and formal Edgeworth expansions, works on large and moderate deviations and their applications to the asymptotic theory of inference, Bahadur efficieny among others. A strong group in the study of optimal designs was formed who made fundamental contributions in this area for several years. Several important results were obtained in the theory of sample surveys and researchers took up study of model-based survey designs, Godambe's theory of estimating equations made major contributions in these areas. In probability theory, finitely additive probability in the strategic set-up was taken up. Indeed, the main contributions to the subject of Markov Chains in this set-up are from this Division. Work on probabilistic number theory settled some conjectures of Erdös. Prediction theory of stochastic processes as well as Hilbert space valued processes were undertaken. Characterizations of distributions was a major area and the results of C. R. Rao and his co-authors in this area are now classic. Scientists of the Division made deep contributions to Filtering and Control theory. A systematic development of quantum probability was initiated. In mathematics, new areas were like functional analysis in Banach spaces, theory of Lie groups and harmonic analysis, graph theory and combinatorics. Researchers in these areas made several fundamental contributions. Some noteworthy contributions were on dialated sets and characterization of simplexes, selection theorems and on study of imprimitivity of locally compact abelian groups.

- During the eighties, areas of research were more focused. In statistics several important contributions were made in optimal designs, approximation and convergence of posterior distributions in Bayesian inference, various limit theorems and consistency and large deviation properties of U-statistics. Inference in stochastic processes, including non-parametric and functional estimation was another major area of contribution. A major addition was the study of newly developed bootstrap technique particularly in the context of time series and dependent data. In probability, Quantum Itô formula was developed, integral representations of quantum martingales were obtained, path-wise formulae for stochastic integrals, useful in statistical inference, were developed. Stochastic integrals on Fock spaces were developed. Interesting results on semi-martingale up-crossings and sojourn times were obtained. The scientists did extensive work on Stochastic Calculus. A multiplicative stochastic integral was developed. Scientists of this Division made fundamental contribution towards the entire development of filtering and control theory, with finitely additive noise. Prediction processes of jump type processes were explicitly constructed. Research on functional analysis, ergodic theory and harmonic analysis, general, algebraic & differential topology, algebra, differential geometry, descriptive set theory and logic, automata theory, graph theory and discrete mathematics continued and several important contributions were made. During nineties and more recently, the scientists of the Division took up two new areas of research in probability theory: percolation theory and study of large random matrices. Scientists of this Division obtained several fundamental results in percolation theory. There is a large group of probabilists who are working on the theory of random matrices currently. In addition, some significant shift was observed in research interest among scientists of this Division towards more application and interdisciplinary research. Along with further development in traditional areas of strength of this Division, important collaborative research started taking shape in bio-statistics, cancer research, genetics, brain mapping problems, environment and other similar contemporary areas of application of statistics. Applications of graph theory in the Social Networks analysis generated a strong response from various researchers in India and abroad. This Division played a major role in popularizing this important inter-disciplinary application. Extensive research is also being carried out in developing stochastic models for large microarray data in collaboration with biologists. Interaction between statisticians and geologists of the Institute continued producing several important publications in geological mapping and morphometrics. Some softwares, such as SWORDS in genetics and BART in image processing were also developed through collaborative research and projects with other external governmental agencies.

- The depth and rigour of the research-level text books and monographs as also the research papers published in Sankhyā and elsewhere in other reputed International journals have earned international recognition of ISI mathematicians, statisticians and probabilists. The Journal Sankhyā started in 1933, published already 68 volumes containing several seminal and path-breaking research articles in the areas of Statistics, Probability and Mathematics, other interdisciplinary research areas, applications, planning and industry.
- Collective efforts of the scientists of this Division led to holding of many national and international conferences / workshops / symposia/lecture series on several areas in Mathematics, Statistics and Probability. This has helped in the updating of their knowledge in the frontiers of research in many areas, as well for dissemenation of the new areas of research to colleges, universities and other academic institutions. Particular mention should also be made of the participation of this Division in various activities organized by the National Board of Higher Mathematics which has been set up by the Government of India for increased activities in mathematical sciences at all levels in the country.
- The scientists of Stat-Math Division have consistently received national and international recognitions. The impressive list includes Bhatnagar Awardees, INSA Fellows, IMS Fellows, Editorial board members of several top-ranked journals in statistics, INA Fellows, Holders of National Professorship, Nehru Fellowship and Nehru Professorship, to mention a few. A substantial number of the scientists in Stat-Math. Division have been honoured by being inducted as Editor(s) / Editorial Board Member(s) of prestigious journals in mathematics / probability & stochastic processes / statistics, such as the Journal of the American Statistical Association and the Annals of Statistics, as well as with the membership in the National Statistical Commission, the Governing Council of NSSO, and the Advisory Committees of CSIR, DST, and NBHM.

11.2 Applied Statistics Division

Since the implementation of the amended Regulations in 1976, the Applied Statistics, Surveys and Computing Division (later renamed as Applied Statistics Division in 1996), came into being to meet the demands of the changing nature of the discipline of statistics as well to reiterate the significance of the role of statistics in national development. Professor J. Roy and other senior statisticians of the erstwhile RTS took a leading role in the shaping of this new Division. One of their major thrusts, from the inception of the Division, was to undertake projects and surveys of national relevance. A list of some of the innovative surveys and projects undertaken is mentioned below.

- **1970s**
  - A socio-economic survey of Calcutta was undertaken to study the poverty and unemployment status of the urban poor, including pavement dwellers. This was done in collaboration with ICSSR.
  - Rural employment of some segments of Assam was studied in another project.
  - A health and socio-economic survey of the Calcutta metropolitan area was conducted by the Division in collaboration with the Calcutta Metropolitan Development Authority.
  - Costs and benefits of rural electrification in West Bengal was studied in a project. This also included predictions of future costs and benefits under different assumptions for future electrification strategies and an analysis of the financial returns of the State Electricity Board.
- **1980s**
  - A survey of foreign tourists was undertaken at the national level to study the profiles of the tourists and their reasons for visiting India. The average expenditure incurred by the tourists was investigated. A similar study was also conducted for domestic tourism.
  - A study was conducted among the fishermen in West Bengal to ascertain their techno-socioeconomic profiles for aiding the government in formulating suitable welfare schemes for the fishermen.
- **1990s**
  - Statistical methodology was developed to estimate the volume of garbage accumulated in a city. These estimates were used in Calcutta to formulate optimal routing schedule of garbage collection and disposal, and has potential use in the garbage disposal planning of other metropolitan cities.
  - A study was taken up to reconcile an anomaly in a RBI claim of issuing rural credit amounting to about twice the NSSO estimate for the same. The study resolved the anomaly and suggested remedial measures.

- A nation-wide tracer study of ITI certificate holders was carried out to evaluate the effectiveness of such technical training programs. The findings were used by the Ministry of Labour, Government of India, to review its policies.

- **2000**s

- Methodology for small area estimation was developed. It was used to provide district level estimates of several socio-economic parameters that are not provided by NSSO.
- Life time distribution of currency notes of different denominations were modeled which aids printing and circulation of currency notes by RBI.
- Other studies included development of models for HIV prevalence, quantification of the air pollution of metropolitan cities, audit sampling covering health sector, Public Works Dept. (PWD), Public Health Engineering (PHE) and Irrigation & Waterways (I&W) sectors, impact of sound pollution on school children, and occupational mobility of SC/ST families.
- The Division had substantial involvement in the organization of important national and international conferences and workshops. A few to mention are Golden Jubilee Conference, International Conference on Recent Developments in Probability and Statistics, R.C. Bose memorial conference, R.C. Bose centenary conference, Indocrypt, and International Bayesian Conference.
- The Division had significant contribution towards the development of survey, design and methodology for all the NSSO rounds. The Division also provides regular training to statistical officers and other government officials on basic and advanced statistical and computational techniques. The Division also took a leading role in the development of the computing infrastructure of the Institute.
- All along its existence the Division has been actively participating in research in the classical areas of statistics such as Sample Surveys, Design of Experiments, Statistical Inference, Multivariate Analysis, Reliability, Survival Analysis etc. Moreover, during recent times the research of the Division has also branched out to new and emerging areas of statistics such as Biostatistics and Epidemiology, Statistical Computing, High-dimensional Problems, Directional Data Analysis, etc.
- Cryptology research in India was pioneered by this Division. The Division has contributed significantly over the last few years to all areas of Cryptology. Indocrypt, International Conference on Cryptology, held at different cities in India, was started by this Division. Collaborations are done with different government agencies such as DIT, ISRO, DRDO, Indian Navy, SPG etc. and solutions to their specific needs are being provided.

11.3 Social Sciences Division

Social Sciences Division presently consists of seven research units which are situated at the headquarters in Kolkata, Delhi and Bangalore Centres, and in Giridih Branch: Economic Research Unit (at H.Q), Planning Unit (in Delhi Centre), Economic Analysis Unit (in Bangalore

Centre), Sociological Research Unit (at H.Q with a branch in Giridih), Population Studies Unit (at H.Q), Psychology Research Unit (at H.Q), and Linguistic Research Unit (at H.Q).

11.3.0 Economic Research Unit / Planning Unit / Economic Analysis Unit

Research in economics is presently carried out in Economic Research Unit, Planning Unit and Economic Analysis Unit.

❑ **Formative period**

- The Planning Division was the original base in Kolkata, where research in economics began to take shape in ISI from 1940s onwards. The first input-output table for India was prepared by the Planning Division of the Institute. After Professor Mahalanobis was nominated as the Chairman of the National Income Committee of Government of India in 1949, he entrusted Professor Moni Mukherjee to carry out certain noteworthy work on national income and allied topics. The series on studies on planning for national development was also initiated.
- However, the spurt in economic research work came, when, in 1954, Prime Minister Jawaharlal Nehru entrusted Professor Mahalanobis and ISI with the responsibility of preparation of the draft Second Five-Year Plan, as mentioned earlier. It was the period when eminent economists, such as Oscar Lange, Joan Robinson, Charles Bettelheim, Jan Tinbergen, Nicholas Kaldor, Simon Kuznets, and Ragner Frisch, came to ISI from abroad and interacted with Professor Mahalanobis and the social scientists of the Institute. It was the time when promising economists, like Amartya K. Sen, Sukhamoy Chakraborty, Asoke Rudra and Ashok Mitra were either frequent visitors to the Institute or engaged themselves as scientific staff in ISI. Meanwhile Deb Kumar Bose, Nikhilesh Bhattacharya and other scientists have also joined the Planning Division.
- At the same time, close collaboration was established between ISI and Planning Commission, Government of India. In this context, C.D. Deshmukh and Pitambar Panth played a crucial role in Delhi at appropriate levels. Gradually a separate Planning Unit came into being in Delhi Centre within the ambit of Social Sciences Division of the Institute. It had, at one time or the other, in its scientific staff such well-known economists as T.N. Srinivasan, B.S. Minhas, S.D. Tendulkar, J. Bhagwati, Pranab K Bardhan, and K.S. Parikh.
- Economic Analysis Unit was formed in Bangalore in 1978, soon after the Institute decided to create a Centre in Bangalore

❑ **Subsequent developments: major features**

11.3.1 Economic Research Unit

- In 1968, Economic Research Unit (ERU) was created in Kolkata out of the erstwhile Planning Division.

- All the scientists of ERU, as a team, carried out two noteworthy preview and review of Indian economy for 1970-71 and 1971-72. During the Golden Jubilee celebration of ISI in 1981-82, ERU organized a National Conference on 'Review of Indian Plans', which was followed up by a Round Table Conference on 'Indian Planning Problems'.
- The Planning Commission, Government of India, entrusted ERU to undertake a significant project 'Coal, Power, Steel, and Transport in the eastern region of India: a study in inter-dependence', in 1974-75. ERU also carried out an ICSSR project on unorganized labour in transport in Calcutta during 1975.
- Since 1983, the scientific staff of ERU have undertaken research in the following frontline areas: Industrial Economics, Resource and Environmental Economics, Planning and Public Economics, Econometric Methods, Applied Econometrics, Social Accounting, Agricultural Economics, Welfare Economics, International Economics, Development Economics, Macro Economics, Micro Economics, Industrial Organization, Regional Economics, and Financial Economics.
- ERU offers (i) four courses on Economics at B. Stat. (Hons.) level per year and one course on Econometrics in the M. Stat. First year, (ii) an one-year specialization in Quantitative Economics in the Second Year of M. Stat. Programme, and (iii) a two-year Master of Science Programme in Quantitative Economics. ERU also takes part in the teaching programme of International Statistical Education Centre.
- A large number of research projects have been undertaken by ERU, of which 12 important projects are listed below.
    - ▼ Currency requirement by denomination: A forecasting model for India (funded by Reserve Bank of India).
    - ▼ ISI-ONGC collaborative project on modeling discovery cost of Hydro-carbon (funded by ONGC).
    - ▼ Regional Model for Agriculture (funded by Planning Commission)
    - ▼ A study on Steel Industry in India (funded by Joint Plant Committee, Ministry of Steel, Govt. of India).
    - ▼ ISI-Hindustan Liver Limited collaborative project on Business Research (funded by Hindustan Liver Limited).
    - ▼ Study on Taxable Capacity (funded by 11th Finance Commission, Govt. of India).
    - ▼ Environmental Management Capacity Building Technical Assistance Project: Environmental Economics component (funded by World Bank)
    - ▼ Sustainable Development Framework for India (funded by United Nations University, Tokyo).
    - ▼ Relative Price of Food and the Rural Poor: the case of India (funded by ILO).
    - ▼ Demand for Products of Rural Industries in India (funded by ILO).

  - Valuation of Ecological Services of Wetlands in India (funded by Ministry of Forest and Environment, Govt. of India)
  - Efficiency of Air Pollution Control Technology in Founding Industry (funded by West Bengal Pollution Control Board)?
  - Development of Methodologies for the Measurement of Poverty (funded by Ministry of Statistics & P.I., Govt. of India)
  - Estimating Poverty at District-level — a Methodological Study (funded by UNDP)
- The following major conferences have been organized by ERU since 1983.
  - Economic Reforms in India, 1997
  - Planning and Economic Policies in India (held as a part of Professor P.C. Mahalanobis birth centenary celebration, 1993)
  - National Income and Wealth in India (17th General Conference of the Association of National Income and Wealth, 1990)
  - National Income and Wealth in India (14th General Conference of the Association of National Income and Wealth, 1983)
- The scientists of ERU had participated in certain important decision-making bodies, such as Governing Body of NSSO, Task Force Committee of Planning Commission, Committee in Ministry of Commerce, Technical Advisory Committee of RBI, and Technical Advisory Group of World Bank.

11.3.2. Planning Unit

- A recent study in the European Economic Review has rated Planning Unit as the third best Economics department in Asia.
- The Unit currently does noteworthy work in economic theory, development economics, and applied work on the Indian economy. Economic theory has recently been undergoing what has come to be known as the "behavioral revolution". This has involved extensive reliance on experimental economics which has called for laboratory and field experiments.

11.3.3. Economic Analysis Unit

- During the last few years, Economic Analysis Unit has successfully conducted training programme on Time Series Analysis and Forecasting for the Officer Trainees of the Indian Statistical Services, Government of India.

11.3.4. Sociological Research Unit

❑ **Formative phase: breakthrough steps**

At the initiative of Professor P.C. Mahalanobis, Professor Ramkrishna Mukherjee established Sociological Research Unit (SRU) in 1957 with the headquarters at Kolkata and a Branch in Giridih (then in Bihar and now in Jharkhand).

- From the inception, the major thrust of SRU was to apply, for the first time in India, statistical method in sociological research with emphasis on inductive inference based on systematic collection of empirical data on social structure and social transformation. The breakthrough was made earlier by Professor Mahalanobis, along with Professor Mukherjee, in the phenomenal work 'A sample survey of the after-effects of the Bengal famine of 1943' (published in Sankhyā, Vol. 7, Part 4, 1946).
- This was followed by a significant project of Professor Mukherjee 'Six villages of Bengal: a socio-economic survey', where he extended further the statistical analysis to explain empirical sociological data in the context of social transformation.
- A large-scale survey was undertaken by SRU during 1960s to collect the basic socio-economic data from Giridih town as well as from 1876 villages around the town. In 1964, a project was completed on the basis of analysis of a part of the same survey data by applying Mahalanobis's D^2 Statistic for the first time in sociological research in India. The resultant paper, written by Professor Mukherjee and Professor Suraj Bandyopadhyay, was published in Contributions to Statistics, a felicitation volume edited by Professor C.R. Rao and presented to Professor Mahalanobis on the occasion of his 70th birthday.
- Thereafter, sponsored by the Planning Commission of Government of India, Professor Mukherjee and his SRU colleagues completed, once again for the first time in sociological research in the country, an extensive sample survey on variations in family structures of West Bengal.

❑ **Interaction with statistics**

- The development of probabilistic graph theoretic methods by Professor Suraj Bandyapadhyay and Professor A.R. Rao (Statistics-Mathematics Unit) to study social network was recognized by the Second ISI Review Committee as an illustration of collaboration between sociology and statistics. This was later published in Sankhyā in 1987, which was subsequently followed up by another publication in Sankhyā in 1996.

❑ **Significant projects undertaken since 1980s**

- Since the end of 1980s, both the externally and internally funded projects of SRU tended to increase, some of which turned out to be noteworthy sociological work with interdisciplinary dimensions and also enriched with statistical methods. Some of the projects yielded results for policy formulation at the level of Central or State Government. Certain examples are given below.
    - A study on the impact of Total Literacy Campaign in the districts of Birbhum and Bankura of West Bengal (funded by Government of West Bengal)
    - Perception and potential of development in Usri Watershed Area in Giridih region (funded by Indian Council of Social Sciences Research)
    - Survey of possibilities of small-scale industries in West Bengal (funded by Government of West Bengal)

- In-depth studies on the levels of development of Scheduled Castes and Scheduled Tribes in West Bengal (funded by the Ministry of Social Welfare, Government of India)
- A study on the status of women in West Bengal (funded by West Bengal Women's Commission)
- Economic reforms and rural development: a study of financial liberalization and rural banking in eastern India (funded by ISI)
- Forms of market and non-market discrimination: the case of rural Dalit households (funded by ISI)
- A comparative study of social network in villages of Jharkhand and West Bengal (funded by ISI)
- Gender and labour: a study of mica industries in Giridih (funded by ISI)
- Socio-economic conditions of five minority communities in West Bengal (funded by West Bengal Minority Commission)

❑ **Symposium/seminar/workshop/conference**

Since 1960s, SRU has organized several important seminars / symposia / workshops / conferences, from which two examples are cited below.

- Post- XI World Congress of Sociology Symposium on 'Ideology, social formation, and transformation' was held in Kolkata in 1986, which was inaugurated by Shri Jyoti Basu, the then Chief Minister of West Bengal.
- On the occasion of Birth Centenary celebration of Professor P.C. Mahalanobis, a National Symposium was held in Giridih on 'Social transformation: different dimensions' in December 1993, which was inaugurated by Professor B.L.S. Prakasa Rao, the then Director of ISI

❑ **Recent developments**

- The Section 8.1 Committee (Government of India), led by Professor A.P. Mitra, FRS, visited Giridih Branch of SRU in July 2006 and, after thorough evaluation, has recommended the possibilities of expansion of research work in Giridih.
- In the context of the ensuing Platinum Jubilee celebration of ISI, a Workshop and an International Conference on 'Social Network Analysis' is scheduled to be jointly organized by SRU and Theoretical Statistics & Mathematics Unit in Kolkata in February 2007.

11.3.5. Population Studies Unit

- In ISI, demography has rediscovered its fundamental vocation as a bridging discipline which governs attempts to identify the laws of interdependence between demographic phenomena and socio-economic phenomena with the help of statistics. Professor P.C.

Mahalanobis was the first to take a broad outlook of demographic research, when he represented India in the Population Commission of the U.N. as early as in 1948. Demographic Research Unit (now known as Population Studies Unit) of the Institute was set up with this broad perspective in view.

- The first major work on population undertaken by the Institute in the 1940s was the Y-sample estimates of the 1941 Population Census, necessitated due to damage of the relevant records during the Second World War.
- The development of a probability model for the estimation of vital statistics was another pioneering work.
- Acclaimed by the United Nations, the estimation of couple fertility and the study of prevalence of contraceptives (the first baseline survey on the subject in the country) even preceded the publication of the famous work of Cole and Hoover (1955) on 'Population Growth and Economic Development in low-income countries'.
- As a member of the Statistical Commission of the United Nations, Professor Mahalanobis's suggestions had led to nationwide sample surveys on population, births and deaths, maternal and child health; these surveys had also resulted in multi-country studies of immense importance, such as the World Fertility Survey and Demographic and Health Surveys. As an alternative to National Register of Population, Professor Mahalanobis had proposed in 1951 that the relevant information could be collected as a part of the National Sample Survey. When implemented, this crucial proposal had laid the strong foundation of demographic database in India.
- Among the long list of research work, a few innovative population studies conducted in the Population Studies Unit may be mentioned:
    - ▼ Reconstruction of actuarial life tables for India: 1901-2001
    - ▼ Measurement of impairment, disability and handicap statistics in India (the resultant Report was recognized as the first of its kind from India at the U.N. Population Division and International Statistical Institute Workshop in Voorburg, the Netherlands, 1994
    - ▼ National policies on population growth
    - ▼ Demographic and health transition
    - ▼ National and international migration
    - ▼ Epidemiological aspects of morbidity and mortality
    - ▼ A pioneering project, sponsored by the European Commission, on the 'Impact of Health Sector Reforms adopted under Structural Adjustment Policy in India', was conducted under the leadership of Population Studies Unit (PSU) during 1997-2001.
- The particular focus of the teaching programme of PSU is given on attainment of high degree of competence in the quantitative aspects of demography and achievement of adequate expertise in statistical theory and applications. In recent times, there is strong

emphasis on computer applications, including data base management, exploratory statistical analysis, and micro-simulation techniques. The Unit has published the results of model-based research and substantive work through research papers, reports and monographs. The scientists of the Unit have often been invited to national and international (e.g. IUSSP) conferences / seminars on population as recognition of noteworthy work done by them.

- The Government of India (Ministry of Health & Family Welfare) has already indicated a positive inclination to set up a Population Research Centre at ISI in order to encourage the Institute to play a more prominent role in formulation of national health and population policies of the countries.

11.3.6. Psychology Research Unit

Psychology Research Unit (originally called Psychometric Research and Service Unit) was set up in 1954 under the leadership of Dr. A. Edwin Harper, a Psychometrician closely associated with the Educational Testing Service, Princeton (USA) to apply statistics on psychological data.

- In Psychology, the important and readily available data were available from admission test scores. The concepts of measurement of Intelligence, Aptitudes, Interests etc were not popular in India in 1950s. Aptitude scores could measure potential ability of the candidates, whereas university marks would be the results of the candidate's potential ability plus his effort. Therefore, to make the selection more efficient, there was the felt need for measuring aptitudes for admission to different courses.
- In response to this need, the Unit began its activities by conducting the admission test for Christian Medical College in Vellore, which was followed up by comparable tests in other educational institutions and organizations.
- Gradually reputed psychologists like Dr. Shib K. Mitra (who later on became the Director of NCERT) and Dr. Rehea Das and a group of young psychologists and statisticians joined the Unit.
- The next step before the Unit was to design suitable admission tests for different courses run by ISI. In 1956, for the first time in ISI, Admission test (psychological) was used to select the students for three-year Advance course in Statistics. Later on such tests were administered to select students for B. Stat and M. Stat courses. These admission tests, however, were continuously revised on the basis of item analysis and validity study.
- Based on the admission tests (purely objective in nature) of ISI courses, a book entitled "Aptitude Tests for Statistics and Mathematics" (written by D. Basu, S. Chatterjee and M. Mukherjee) was published by Statistical Publishing Society in 1966. Here, the difference between questions measuring Mathematical Knowledge and Mathematical Aptitude was clearly depicted, which enumerated the need for measuring Aptitude apart from Knowledge. The book was widely acclaimed in the country and abroad.
- From 1970 onwards the Unit was engaged with the recruitment tests for different Industrial organizations. Simultaneously, the Unit was associated with the admission test of IIM, Calcutta, for seven years.

- In 1980s, a noteworthy survey was carried out by Shri T. Basu Mallik and other scientists of the Unit on the problems of school education.
- Apart from the services rendered to different organizations and institutions, the scientific staff of the Unit did commendable research work in the following areas, particularly during the last 15 years :
  - ▼ Psychometrics / Test construction
  - ▼ Educational Psychology / Evaluation of Educational System
  - ▼ Organizational and Entrepreneurial Behaviour
  - ▼ Social and Developmental Psychology
  - ▼ Cognitive Psychology

The scientific staff of the Unit were also invited to give lectures and conduct training programmes at various institutions, and they presented their research findings in several national and international conferences in India and abroad. An important International Conference on 'Item Response Theory' was held in the Unit in 1996. Certain significant projects were completed by the scientific staff of the Unit, some of which are given below:

- Entrepreneurial Behaviour and Individualism - Collectivism.
- Socialization and Cognitive Moral development of children across cultures.
- Cognitive - Moral Development of children in the North -Eastern region of India.
- Effect of Traffic noise on Hearing Ability of school children of Kolkata (with Applied Statistics Unit).
- Evaluation Work of State Resource Centre -ADRI, Patna (funded by Ministry of Human Resource Development, New Delhi)
- Impact Assessment of Workers' Education (in collaboration with Central Board for Workers' Education, Ministry of Labour & Employment, Government of India).

11.3.7. Linguistic Research Unit

- Research in the area of statistico-linguistic analysis was taken up in the 1940s by Shri Jibanmoy Roy, under the close observation of Prof. P.C. Mahalanobis, in order to: i) work towards a standard primer based on Standard Colloquial Bangla, ii) prepare graded word lists from text books for children of different age groups, and iii) study the vocabularies of canonical Bangla authors by carrying out word count and frequency ranking from selected texts by representative authors, such as Bankimchandra Chattopadhyay, Rabindranath Tagore and Saratchandra Chattopadhyay.
- In 1968, Prof. Djordje Kostic, a renowned linguist from undivided Yugoslavia, visited I.S.I. at Professor Mahalanobis's invitation. He initiated ISI's Linguistic Research Unit (LRU) into the area of speech pathology research; the Unit was able to plan and implement a rehabilitation programme for hearing impaired children. Dr. Ria Das, the then Head of the

Unit, worked closely with Prof. Kostic; the results included major publications on acoustic aspects of Bangla phonetics and basic articulatory norms of Bangla speech-sounds. During his visits to Kolkata, Prof. Kostic met Prof. Suniti Kumar Chatterjee, National Professor. This gradually developed into a creative relationship of mutual trust and respect.

- Dr. Alokananda Mitter joined LRU in1971 as the Head of the Unit. The Unit formally started collaborating with Belgrade Institute in 1973. Collaborative research in speech pathology resulted in a test battery for articulator evaluation of Bangla speech sounds developed by Prof. Kostic and Dr. Mitter. During this period, the twenty seven channel SAFA (selected auditory filter amplifier), designed by Prof. Kostic, became popular all over the world. Apart from joint wotk with Belgrade University on speech pathology, the Unit also undertook joint work on suprasegmental features of Indian languages with Prof. Nagamma Reddy, a phonetician based at Osmania University, Hyderabad. Research on speech sounds in major Indian languages in terms of the Distance (D2) concept by Prof. Kostic, Dr. Mitter, Dr. Rastogi and Dr. Sharma sparked new interest in the quantitative macrolinguistics of Indian languages. A comparative study of vocables in Bangla and Serbo-Croatian and a frequency count of Serbo-Croatian were two major outcomes of this period of activity.
- After the retirement of Dr. Mitter, the interest in quantitative linguistics at the Unit moved towards a socio-linguistic and computational direction, in keeping with a national shift of focus. The first workshop on quantitative linguistics, held in 1995, highlighted a phase of collaboration among statisticians, mathematicians, computer scientists, sociologists, psychologists, literary critics and linguists.
- At present the Unit has initiated research that bridges the gap between quantitative-social concerns and lexico-syntactic study by using tools from cognitive linguistics.

11.4 Biological Sciences Division

☐ Formative phase: salient features

- Professor Mahalanobis's interest towards biology developed and deepened when he met Dr. Nelson Annadale in 1920 at the Indian Science Congress Session in Nagpur. Dr. Annadale had handed him over anthropometric data on the Anglo-Indians in Calcutta for statistical analysis which resulted in his first scientific paper on the 'Statistical Analysis of Anglo-Indian Stature: Male', published in the Records of the Indian Museum in 1922. Mahalanobis continued his statistical analysis of anthropological data and he made use of the D^2 statistic for the first time. His another contribution was the revision of H.H. Risley's anthropometric data on Indian population by using statistical methods. Professor D.N. Majumder, the then Head of Anthropology Department of Lucknow University, extended his active support to Professor Mahalanobis by providing him data from anthropometric surveys in U.P. and Bengal, which yielded in a series of landmark publications. The prevailing view that castes were distinguishable by 'racial criteria' appeared untenable by this research work of Professor Mahalanobis.

- In 1924, Professor Mahalanobis published a paper on the probable error of field experiments in agriculture, without even knowing about the revolutionary work of Sir Ronald A. Fisher, which attracted the attention of Sir Ronald. Their friendship began to grow and produced a very creative impact on the shaping of research and teaching policies of Indian Statistical Institute in the subsequent decades.
- Several eminent scientists in the field of Biology, attracted by innovative research work of Professor Mahalanobis, began to visit the Institute from abroad. They included luminaries like Ruggle Gates, Julian Huxley and G.L. Stebbins, while Professor J.B.S. Haldane joined the Institute in 1957.
- During 1960s, researches in ISI in the field of human adaptation to environment, more particularly in "Stress Research", were undertaken in collaboration with Professor H.L. Shapiro, which was popularly known as Shapiro project.
- At about this time, there had been a spread of research activities in the field of Serology and blood polymorphism. The research work expanded to include new human genetic traits. Later on, an Indo-Soviet collaborative study (with USSR Academy of Sciences) was undertaken on the Indian and Central Asian population, using several anthropological and genetic parameters.
- Research work was initiated in the field of molecular embryology, embryogenesis, biological clock, and chemical ecology.
- In 1970, research on leaf protein was introduced with the keen interest and support of Professor N.W. Pirie, FRS, and Professor R.L.M. Synge, Nobel Laureate.
- Prof. K.C. Malhotra and other senior scientists took a leading role in this period.

❑ **Recent developments**

- Presently Biological Sciences Division consists of three research units: (i) Human Genetics Unit, (ii) Biological Anthropology Unit, and (iii) Agricultural and Ecological Research Unit. The Division has tended to focus its research on areas such as, agriculture; ecology and environment; genomics, proteomics and bio-informatics; health systems; and bioethics.
- The main theme of agricultural research would be to ascertain a stable and sustainable production of crops under natural resources. Inter-disciplinary studies in agro-ecosystems and forest ecosystems need close interaction among agronomists, botanists, ecologists, and statisticians including GIS specialists. The major interrelationship with statistics will be in areas of design of experiments, multivariate analysis and pattern recognition.
- Ecology and environmental research will exploit different fields like global change regarding climate, human impact, land use, water availability, pollutants, agricultural demands, and changes in biodiversity with special emphasis on ecological monitoring and modeling. Nature of interaction with statistics will include formulation of innovative sampling designs and multivariate measures of ecological status and assessment of temporal changes of

these measures. Genomics, proteomics and bio-informatics research will continue, with the foci on a) population-based genetic approaches to the study of common diseases, such as cancer and cardiovascular diseases and b) identification of DNA variations in populations that contribute to differential responses to treatment regimens for common diseases. Basic research would continue on human diversity, inheritance of human morphological traits, genetic structures of population and evolution. Greater emphasis will be placed on development of statistical methods for mapping genes for diseases, evolutionary inference, and DNA sequence analysis.

- Health system research will be devoted to holistic studies of health and related traits in populations at different transitional phases, which will lead to deeper understanding of gene-environment interactions, and result in formulation of improved policies for prevention of diseases and health management. Multivariate statistical analysis will be the major statistical aspect of health systems research.
- Bioethics is an emerging inter-disciplinary field of research and its primary interrelationship with statistics will be in the formulation of sampling schemes and discrete multivariate methods.

11.5 Physics and Earth Sciences Division

This Division presently consists of two Units: (i) Physics and Applied Mathematics Unit (PAMU), and (ii) Geological Studies Unit (GSU). The main activities of PAMU are in the areas of Theoretical Physics and Applied Mathematics. Among the significant activities undertaken in this Unit, the following landmarks may deserve attention:

11.5.1 Physics and Applied Mathematics Unit (PAMU)

- Theoretical Physics
  - Work on Topological aspect of Quantum hall effect and Berry phase.
  - Fractional Hall effect in Condensed matter physics.
  - Mathematical modeling of q-dot likes few electron systems.
  - Work on Supersymmetric Quantum Mechanics yielded solutions of some important Schrodinger problems, which were non-known hitherto, and a generalization of Darboux result on Isospectral Hamiltonians. In this context, important work was done on PT Symmetric Quantum Mechanics, which was widely acknowledged as shown by the citation index of some of the papers on this topic. Work on 1/N perturbation method and group theoretic method for Relativistic Dirac Problem was also well recognized.
  - In Quantum Information the work on 'Bell's Inequality and Quantum Contextuality' proved contextuality of quantum mechanics by experiments using Neutron (2003). The contextuality in quantum mechanics was shown beyond doubt by an experiment done by Rauch et al [Nature 425,45(2003)]. Some subsequent works provided a methodology for the first time to prove that some sets of orthogonal entangled states

can not be distinguished by local operation and classical communication and another work revealed the general relation between information about identity of entangled state by local operation and classical communication and entanglement distillation. All these works generated considerable interest among the scientists in this area.

- Dynamical Multiple Scattering (DMS) theory was developed in PAMU and its experimental consequences are being verified in NPL, New Delhi.
- In Quantum Optics significant work was done on coherent and squeezed states.
- In High Energy Physics successful work was done in the field of heavy ion collisions in high-energy nuclear physics and modeling data on hadrons nucleus interactions.
- Important and original work was done on Unified Gauge Theory in 2+1 dimension and on Hamiltonian formalism of the relativistic spinning particle. The last work has been widely acknowledged.
- Exact Sagdeev's potential was obtained for the first time in relativistic Plasma. This technique is extended to dusty plasma problems successfully to obtain solitary wave solutions in plasma.

☐ **Applied Mathematics**

- Significant work was done on Singular Integral Transformation and on Integral equations, particularly their applications in Water Waves.
- Significant work on sediment transportation was done both theoretically and experimentally in Flume Laboratory of ISI. This work is of considerable importance in pollution control studies.
- Work was done on thermo-capillarity in spin coating process, which has application in industry. Significant work was also done on hydro-magnetic instability specially on the stability characteristic of a thin conducting liquid film flowing down on a non-conducting plane in presence of electromagnetic field. Another important work done was on nonlinear waves on the surface of a falling film of power-law fluid on vertical plane.
- Work on nonlinear instabilities specially on physical systems far from thermodynamic equilibrium was widely acclaimed.
- Work on turbulent flow was done using group theoretic technique. An important area of study was on Homogeneous isotropic Turbulent flow.
- Useful work has been done on multivariable control systems.

11.5.2 Geological Studies Unit (GSU)

The landmarks of Geological Studies Unit may be delineated below.

- The Geological Studies Unit (GSU) was establised by Dr. Pamela L. Robinson in 1957. Initial focus was on the integrated research on the geology of Pranhita-Godavari (PG) valley basin and field data collection.

- A major turning point was the discovery, collection and reconstruction of Barapasaurus tagorei, a Lower Jurassic sauropod dinosaur. A fully mounted skleleton of Barapasaurus, first of its kind in India, was placed in the Geology Museum.
- Active collaboration took place with statisticians for development of new statistical tools for palaeocurrent analysis and application to Gondwana fluvial deposits. Flume laboratory was established for gaining insights into fluvial sediment transport and deposition through experimental work.
- Substantial knowledge-base was generated on the PG valley geology including the Gondwana (Carboniferous-Permian + Mesozoic) and the Proterozoic rock groups and Gondwana fossil biota, their taxonomy and evolution. The Geology Museum became a rich repository of Gondwana vertebrate fossils including sauropod dinosaur, fish and amphibians. The Geology Museum began to attract researchers from all over the world.
- Activities were extended to related Proterozoic cratonic basins, namely Chattisgarh and Cuddapah basins and the Eastern Ghats belt and the Satpura Gondwana.
- Integrated basin analysis approach brought in new lights on paleogeography, depositional systems, paleoclimate and multiple episodes of basin initiation, inversion in the context of Proterozoic Supercontinent break-up and assembly and Proterozoic fold-and-thrust belts.
- New geochronological and geochemical data were generated from the Eastern Ghats granulite belt bearing on deeper crustal evolution and new petrogenetic model for origin of massif type charnockite.
- New software was developed for geological data analysis and representation including directional data and fossil shapes and GIS approach.
- New insights were obtained in respect of crustal flow and fabric based on quantitative measurements on naturally deformed shear zone rocks, numerical simulation and theoretical modeling.
- Studies were initiated on numerical simulation of river flow, and river dynamics of sub-Himalayan alluvial plain in northeast India, bearing on flood hazards and mitigation.
- A thermo-tectonic model was developed for Convergent Orogens with application to the Eastern Ghats Orogenic Belt.
- Physicochemical studies on surfactant Microemulsion, initiated in 2002, have important impact in the fields of ‘nanoscience’ and ‘environment’.

11.6 Computer and Communication Sciences Division

- ISI has a long history of computer science research and education, and is one of the very few institutes in the country that started deploying computers for various computational purposes in the early fifties. The first electronic computer in India, HEC-2M, was installed in 1956 followed by URAL-1 in 1959. The Golden Jubilee (1956-2006) of computer operations in India coincides with the Platinum Jubilee of the Institute, and is marked with its humble beginning at ISI in 1956. The foremost formal course in computer science of the country was introduced in the Institute in 1963. At present, the Institute runs masters and doctoral programs in computer science, which are highly rated by the peers both in India and abroad. Research and developmental efforts in Computer Science and Engineering have witnessed a phenomenal growth at ISI, particularly, over the last three decades. As evident from the international citation indices, the Computer and Communication Sciences Division is now well known for having made several pioneering contributions to the fields of pattern recognition and image processing, soft computing, VLSI design and test, algorithms and architecture, document analysis, optical character recognition, speech analysis, neural network and fuzzy logic.

- This Division, which was formed in 1996, consists of four units: (i) Advanced Computing and Microelectronics Unit (ACMU), (ii) Computer Vision and Pattern Recognition Unit (CVPR), (iii) Electronics and Communication Sciences Unit (ECSU), and (iv) Machine Intelligence Unit (MIU). Formation of this Division was a culmination of a series of landmarks since 1950, as indicated earlier, bringing into a central stage the need for the development and use of accurate and fast computing equipment for the efficient processing and analysis of data. Professor Samar Mitra, Professor Dwijesh Datta Mazumder and Shri Ashis Sen, along with other senior scientists, contributed to this process of rapid development of computer and communication sciences in ISI in tune with the vision of Professor P.C. Mahalanobis.
- The basic activities of **ACMU** are focused around VLSI design and test, theoretical computer science, algorithms, computer architecture and networking. Currently, the major thrust of ACMU is on mobile and pervasive computing, CAD for VLSI, gigascale integration, nanotechnology, low-power computer architecture, quantum logic, on-chip image processing, computational and digital geometry, MEMS, bio-chips, and computational biology. The VLSI Research Lab at ACMU is one of the earliest laboratories set up in India that initiated research and training in microchip design and testing in the eighties.
- The **CVPR** Unit has been conducting pioneering research work in the area of optical character recognition and document analysis for several Indian languages. The latter problem is extremely important in a multi-lingual country like India. Its other thrust areas are image compression, signal processing, cryptanalysis and bio-informatics.
- The **ECSU** is engaged in development of theories in the areas of image analysis, fuzzy sets and systems, deformable templates, morphology, computational intelligence as well as in development of methodologies for documents processing, text retrieval, satellite image analysis, and tracking of moving vehicles for surveillance. The unit is also working on knowledge discovery from gene ontology using fuzzy set theoretic approaches.
- The **MIU** is one of the leading research schools in the world in the area of soft computing, pattern recognition and machine learning with several international collaborations and achievements. Currently, its application areas are concentrated mainly in bio-informatics, data mining and web intelligence (supported by both national and international funding

agencies) for problems like protein folding, protein structure mapping, neuro-fuzzy data mining, DNA sequencing (fragment assembly); and web page ranking, personalization and application of wavelet and signal processing tool for image analysis & content image based retrieval respectively. It may be noted that statistics, being one of the best paradigms for learning, becomes obviously a tool for machine intelligence, neural learning, data mining and web intelligence. Besides continuing these, MIU focuses on highlighting further the fundamental issues on the following classical and modern areas: pattern recognition; biometric and medical image analysis, data mining and knowledge discovery; evolutionary computing and artificial immune system; soft machine learning and granular computing; brain modeling; computational theory of perception (CTP); case based reasoning; colour/gray image processing and analysis; digital watermarking/steganography; hybridization of different soft computing tools like neuro-fuzzy, rough-fuzzy, rough-neuro-genetic systems. CTP will get special attention.

- The **Center for Soft Computing Research: A National Facility** has been established in 2005 at ISI with funding from the Department of Science & Technology, Government of India. This is Asia's first centre that is devoted for conducting basic research in the frontier areas of soft computing.

Professor Lotfi A. Zadeh, the founder of fuzzy set theory, has observed that there are three essential ingredients for dramatic success in computer applications, namely, fuzzy model of data, Bayesian inference and genetic algorithms for optimization. Similarly, statistical science will be a part, in many ways, for the validation of the tentative model of the human brain and its functions and properties, including consciousness.

- **Some major achievements**

- According to the DSIR (Government of India) report 1994, ISI was ranked Second in India in the field of Computer and Communication Sciences, on the basis of the impact factor of the journals where the results are published. In a recent survey (2002) undertaken by the INSDOC, ISI is now found to rank number one among all the institutes/universities/research labs in India, in regard to high-quality published research in Computer Science.
- As a mark of recognition of the research work on Pattern Recognition and Image Processing, the Department of Electronics (Government of India), jointly with UNDP, selected ISI as one of the nodal centres for Fifth Generation Computing System project in 1980s.
- As a recognition of outstanding achievements in soft computing and machine learning, the Department of Science & Technology, Government of India, has established in 2004 under its IRHPA programme, the country's first soft computing centre in the Institute, called "Centre for Soft Computing Research: a National Facility".
- In view of the leading research work done in language technology by the CVPR Unit, the Institute was selected by the Ministry of Information Technology, Government of India, as one of the resource centers for Indian language technology development, in 2000.

- The ACMU and MIU in collaboration with the Intel Corporation, USA have designed the *first biometric microchip of the country* in 2004, and produced other fundamental intellectual property related to image processing that led to 9 *United States Patents*.
- Several significant contributions to image retrieval, system security, watermarking, and steganography, made by the ISI scientists have been granted United States Patents.
- Among the scientific staff, currently there are 10 Fellows of the Indian National Academy of Engineering (INAE), 5 IEEE Fellows, and several Fellows of the Indian National Science Academy (INSA), and the TWAS – the Academy of Sciences for the Developing World, and awardees of S. S. Bhatnagar Prize, G. D. Birla Award, Jawaharlal Nehru Fellows, and several other national and international award winners.
- Around 20 well-known textbooks/research monographs have been authored/co-authored by the scientists of this Division in various areas of computer science and engineering.
- Among the scientific staff, there are editors of several international journals of repute.
- A new international journal related to Computational Mathematics / Statistics / Systems / Cybernetics will be published by the Institute soon through an international publisher.

❑ **New applications integrating Computer Science and Statistical Science**

Some of the models and tools that have been developed by integrating statistical science and computer science, have found new applications to biological, physical and social sciences. They include:

- ▼ Mining of amino acid sequences and genomic data in bio-informatics;
- ▼ Generating insecticides with nano particles in soft computing framework;
- ▼ Numerical simulation of river dynamics and analysis of geological forms;
- ▼ Morphometric analysis of fossil skulls;
- ▼ Social network analysis.

The Division now has around 40 scientific staff, who are engaged in several emerging areas of theoretical and applied computer science research at ISI in Kolkata. The publication records of the members of this Division in international journals are of exceptionally brilliant standard with high citation. Activities of this Division will shortly be extended to the ISI Delhi Centre and to the ISI Bangalore Centre. The Division organizes many international conferences and workshops every year. At present, nearly 25 doctoral students and 50 masters students are engaged in this Division. A large numbers of externally-funded research projects are currently being conducted in collaboration with various industries and universities in India and abroad.

11.5 Statistical Quality Control & Operations Research (SQC & OR) Division

- The epoch-making publication of "Economic Control of Quality of Manufactured Products" by Dr. Walter A Shewart, the founding father of Statistical Quality Control, almost coincided with the formation of Indian Statistical Institute in early 1930s. Professor Mahalanobis was quick to recognize the relevance of Statistical Quality Control (SQC) not merely as an operational tool for improving product quality but also as a powerful accelerator and catalyst for economic development of the country. He invited Dr. Shewart to visit ISI, who arrived in November, 1947 and spent three months visiting industries, lecturing on SQC and holding discussion with key industry people. This marked the beginning of quality movement in India.

- Late in 1948, Professor Mahalanobis took the initiative in moving the Government of India to bring in an expert team in quality management from United Nations Technical Assistance Administration (UNTAA) to India. On the recommendation of the UNTAA team, an advisory committee of the Government under the chairmanship of Shri C D Deshmukh with Shri Pitambar Panth as the secretary, entrusted ISI with the mission of setting up SQC units with a view to assist Indian industries and service organizations in introducing modern quality management practices. Conceived as a catalyst to countrywide economic development, the main thrust was given to make SQC work at shop floor level for optimum use of domestic resources with a view to manufacture high quality products at low cost.
- The first SQC unit was set up in Mumbai in 1953. The very next year (1954), two more SQC units, one at Bangalore and the other at Kolkata, were formed. Eight more SQC units in eight other cities of the country were established by 1959. Later the SQC units were renamed as SQC & OR Units which began to function under the SQC & OR Division of the Institute since 1976.
- Starting from simple exercises for reduction of waste, scrap and improvement of quality for individual operations, the Division increased its domain in the field of quality management to cover the entire range of activities of organizations in the manufacturing, service and IT sectors. To achieve this, the Division has been constantly upgrading its own quality of knowledge and practice. Every pioneer in the field of quality management contributed to these efforts. Besides Walter A. Shewhart and W. E. Demming, eminent stalwarts like R.A Fisher, S.S Shapiro, D.J Desmond, W. R. Pabst, J. M Juran, L. H.C Tippet, T. Tsuda, E. R. Ott, G. Taguchi, and Jeff Wu worked closely with the specialists of the Division. The well-known methods of Taguchi took concrete shape through applications in the Indian industries by the SQC & OR units, along with Genechi Taguchi and his team. Today the Division takes up about 150 service assignments every year for quality initiatives like SPC, ISO 9000, ISO 14000, and Six-Sigma and also undertakes studies of Operations Research for optimum utilization of resources and productivity improvement.
- The criticality of education and training to the growth of quality consciousness and futility of installing control systems at plant level without motivating those running the operations have been recognized in the early years of SQC & OR. Training, therefore, formed essential service inputs to industry and students community. Over the last five decades, the Division trained over one million managers, engineers, supervisors and operators in various aspects of quality management and operations research. In 1993, the Division embarked on a massive Quality Mission Project financed by Government of India to equip the trainers in

the field of quality assurance and quality management. The project continued successfully till 2002 and trained scores of trainers in the field of quality management for Indian Industry.

- The SQC-OR Division introduced Post-Graduate Diploma programme in SQC& OR in early 1960s at H.Q. in Kolkata, which was the first of its kind in India. Since 1989, this programme was elevated to a two-year full time M.Tech (Quality, Relaiability and Operations Research) programme which continues till date. Besides, a large number of programmes, geared to the needs specific to organizations, are conducted.
- Professor C R Rao, the eminent successor of Professor Mahalanobis, hailed the development of SQC most eloquently : “there has rarely been a technology invention which is so wide in application and yet so simple in conception, which is so effective in its results and yet so easy to adopt and which yields so high a return and yet so small an investment.”

12. CELEBRATION OF THE GOLDEN JUBILEE OF ISI

- The Golden Jubilee celebration was inaugurated by Smt. Indira Gandhi, Prime Minister of India, in the campus of the Institute in Calcutta on 29th January 1982 at a meeting presided over by Shri Subimal Dutt, President of the Institute. Besides the Prime Minister, Shri P.N. Haksar, Chairman of the ISI Council, Shri S.B. Chavan, Minister for Planning, Shri Pranab Mukherjee, Minister of Finance, Professor C.R. Rao, Profesor G. Kallianpur, and Professor B.P. Adhikari, Director of ISI, spoke at the meeting.
- Six conferences and three symposia were held during the Golden Jubilee celebration.:
    - Conference on Statistics: Applications and New Directions, Calcutta, 16-19 December 1981
    - Conference on Review of the Indian Planning Process, Calcutta, 30 December - 3rd January 1982
    - Conference on Theory and Applications of Random Fields, Bangalore, 4-10 January 1982
    - Conference on Advances in Information Sciences and Technology, Calcutta, 11-14 January 1982
    - Conference on Human Genetics and Adaptation, Calcutta, 1-5 February 1982
    - Conference on Quality Control, Reliability and Operation Research, Delhi, 18-20 February 1982
    - Symposium on Economic Theory & Planning, Bangalore, 3-5 December 1981
    - Symposium on Price and Distribution Controls in the Indian Economy, Delhi, 22-23 February 1982
    - Symposium on Women, Work and Society, Delhi, 22-23 September 1982

13. LIBRARY, DOCUMENTATION AND INFORMATION SCIENCES

- The nucleus and the growth of the library

  The nucleus of the Institute library can be traced in the modest collection of Rs.25,000 worth of books, journals, and reports of the Statistical Laboratory which was set up by Professor P. C. Mahalanobis at the Presidency College, Calcutta, which paved the way for formation of Indian Statistical Institute in 1931, as mentioned earlier. Out of this modest collection, Professor Mahalanobis made significant contribution to build an excellent library and also actively participated in developing its collection. The richness of the contents of its collection in statistics, mathematics, quantitative economics, computer science, and in several other subjects led the Second ISI Review Committee to suggest : "It may be useful if the Institute prepares a detailed scheme for developing it into a national library of statistics."

- The evolution of the library

  During the formative years, the library's collection mainly grew through gifts, donations and exchange of publications with Sankhyā : the Indian Journal of Statistics. Early contacts with the Central and the State Governments, learned societies, and research institutions in India and abroad enabled the ISI library to develop a rich collection of books, scientific journals, statistical reports in almost all the major languages of the world. The Institute library received a large number of publications in Russian language from the Lenin Library, Moscow and USSR Academy of Sciences. During the early 1950s, an Asian section was developed in the library for collecting publications from the developing countries of Asia. The library had acquired a substantial number of publications in Chinese and Japanese languages. The library's Translation Unit translated several scientific and technical books and research papers into English from Russian, German, French, Spanish, Chinese and Japanese languages.

- Rare Collections

  Among the precious holdings of the library, mention should be made of the microfilm copy of Buchanon Hamilton's monumental work known as "Buchanon-Hamilton Collection" on the economic survey of India from 1807 to 1814. Mahalanobis took personal interest in procuring this collection from the India House Library, London, with the cooperation of Professor Ramkrishna Mukherjee. The ISI library became the repository of statistical reports, survey reports and other reports of the Governments, learned societies, research institutes, and international organizations. One of the most outstanding collections of the library is its rare assemblage of historical books and journals, such as Arthasastra by Kautilya, Ain-i-Akbari, written by Abul Fazal, Survey of Eastern India by Francis Buchanon (1807), the History, Antiquities and Statistics of Eastern India (3 Vols.) by Montgomery Martin (1838), Statistical Account of Bengal (20 Vols) by W.W. Hunter (1870), and the rare issues of Journal of Statistical Society (1839 issue), Journal of Royal Statistical Society (1889 issue), and Biometrika (1901 issue), which provide the scholars with valuable source materials for research.

- Gift Collections
    - Walter A. Shewhart Collection : Professor W.A. Shewhart, founder of Statistical Quality Control, bequeathed his personal library, comprising about 4000 valuable books, reprints, letters, personal papers, to the ISI library.
    - P.C. Mahalanobis Collection : Professor Mahalanobis's personal collection of more than 4300 books, journals, and reprints was donated to the ISI library. This valuable collection has a number of first editions of Rabindranath Tagore's books, some of which contain autographs of Tagore. This collection is also enriched with valuable books on and by Raja Rammohun Roy, and rare papers and correspondence of Professor Brajendra Nath Seal.
- Documentation Research and Training Centre, Bangalore

  Professor Mahalanobis took the initiative to establish the Documentation Research and Training Centre (DRTC) to train specialists in documentation work in India as well as in other developing Afro-Asian countries. The Centre was formally inaugurated by Shri C.D. Deshmukh, President of the Institute, on 18th August 1962. Dr. S. R. Ranganathan, a doyen of the library and information sciences, served as the Head of the Centre.
- Recent developments
    - With the reorganization of the scientific activities of the Institute following the amendments of the Regulations of ISI in 1976, the ISI library has been given the status of a Division. The Library, Documentation and Information Sciences Division comprises (i) the Central Library at H.Q. in Kolkata with a network of library facilities in Delhi and Bangalore Centres, and (ii) DRTC in Bangalore.
    - Currently the Central library has about 2,25,000 books, bound journals, reports and records in its collection. Library and Information services in ISI have shown marked improvement in the recent years to reach out to provide the required inputs to the scientific staff, students, research scholars, and the members of the Institute. The library has developed well equipped reprography and photography section. Constant expansion of library in augmenting its resources, through a systematic acquisition policy, organizing exchange relations with institutions, both national and international, and inter-library cooperation, has made the ISI library one of the richest libraries in the country, particularly in the fields of statistics, mathematics, computer science, economics and other disciplines of natural and social sciences. The Central Library at H.Q. and the library in Delhi Centre have also been recognized as the regional libraries by the National Board for Higher Mathematics since 1989. It is preparing a searchable bibliographic database on scientific contributions made by the ISI scientists on all subject fields since 1934.
    - The convergence of information and technology has led to computerization in library services, which has opened up possibilities towards 'information access'. This will envisage a variety of modernized library services in the coming years which would

include Web-OPAC, Automated Circulation, Online Document Delivery, CAS through e-mail alerts, online access to Full-Text journal and data bases. Collection of electronic/ magnetic resources, such as CD, Computer files etc. would be essential for marshalling Census data, Statistical and Economic datasets. It is necessary to have an 'Organizational Repository', through an open source software, for projecting visibility and publicity of ISI library activities for proper impact on the outside world.

- As a part of the Central library, the renovated 'Amrapali' building, which was the residence of the founder of the Institute, now houses P.C. Mahalanobis Memorial Museum & Archives, which was formally inaugurated by Shri P.V. Narasimha Rao, the then Prime Minister of India, on 29th June 1993. This museum and archives provide the scientists with the rare source materials and museum displays on the life and research work of Professor Mahalanobis, along with his interaction with Sir Ronald A. Fisher, Professor J B S Haldane and other luminaries who stayed at or visited Amrapali on several occasions. The computerized archival record management system is soon going to be introduced there to meet the research requirements in a more systematic manner.
- The path-finding DRTC programme initiated by Dr. S.R. Ranganathan, at the inspiration of Professor P.C. Mahalanobis, would be enhanced further in Bangalore Centre of ISI through dissemination of specialized training, upgradation of courses, and conducting workshops and seminars.

14. BIRTH CENTENARY CELEBRATION OF PROFESSOR P. C. MAHALANOBIS

- The Birth Centenary celebration of Professor P.C. Mahalanobis was inaugurated at H.Q. in Calcutta by Shri P.V. Narasimha Rao, Prime Minister of India, in a special function on 29th June 1993, who delivered his speech in the meeting, which was presided over by Professor M.G.K. Menon, President of the Institute. Besides the Prime Minister of India, and the President of the Institute, Shri P.N. Haksar, Chairman of the ISI Council, Shri Jyoti Basu, Chief Minister of West Bengal, and Shri Pranab Mukherjee, Minister of Commerce (Government of India), and Professor B.L.S. Prakasa Rao spoke in the meeting.
- Shri P.V. Narasimha Rao, Prime Minister of India, inaugurated P.C. Mahalanobis Memorial Museum and Archives, located in Amrapali on the same day.
- A special function was jointly organized by the ISI Workers' Organization and the ISI Club on 28th June 1993 to pay homage to the life and work of Professor Mahalanobis.
- The ISI Alumni Association and the ISI Society jointly celebrated 4th July 1993 as P.C. Mahalanobis Remembrance Day.
- A series of symposia, seminars, lectures and conferences were organized to celebrate the Birth Centenary of Professor Mahalanobis.
    - Conference on Planning and Economic Policy in India, Calcutta, 29 June – 1 July, 1993

  - Special Lecture by Professor P.V. Sukhatme, former Director of FAO, on 'A New Dimension to the Poverty Problem of the country' on 6 November,1993
  - Two Special Lectures were organized at Calcutta during 8-11 December 1993; Professor Madhav Gadgil gave his lecture on 'People of India: Interpretation from Demographic and the Mitochondrial DNA evidence', while Professor Ramkrishna Mukherjee delivered his lecture on 'History of Anthropological Thought'.
  - Symposium on Sample Surveys: Theory and Methods, Calcutta, December 15-17, 1993
  - International Conference on Environmental Problems: Issues, Statistical Models and Methods, Calcutta, 20-22 December 1993
  - Symposium on Social Transformation: Different Dimensions, Giridih, December 25-26, 1993
  - Third International Conference on Advances in Pattern Recognition and Digital Techniques, Calcutta, December 28-31, 1993

- P.C. Mahalanobis Memorial Lectures were initiated in order to invite eminent scientists from India and abroad to deliver special lectures in the research areas where Professor Mahalanobis had left behind his lasting contributions.

15. CHERISHED VALUES IN ISI

- The Institute encourages certain values, such as free questioning spirit and cooperative ethos, and nurtures a democratic structure for decision-making process at appropriate levels. These are mostly anchored in the unique tradition initiated by Professor P. C. Mahalanobis and nourished by his able successors through the framing of the Memorandum of Association and the Regulations of the Institute.

- There is a healthy relationship of cooperation between scientific and non-scientific workers of the Institute who are traditionally organized under one ISI Workers' Organization. This workers' organization is empowered by the Regulations of the Institute to enter into discussion with the Director and other officers for deliberation on policy matters relating to service conditions and welfare of all categories of workers, both scientific and non-scientific.

- In December 1959, on the occasion of the 27th anniversary meeting of ISI, Professor Mahalanobis was eloquent and forthright on the need of workers' cooperation: "This is the one point which I have been stressing almost every year ... I realize more and more as I grow older that the Institute has been strong when the workers did their work as a team with a cooperative spirit... In the history of the Institute we have always found that when the workers were united, external opposition was perhaps the greatest stimulus, the greatest challenge to progress". This inspiring speech of Professor P.C. Mahalanobis has guided all categories of the ISI workers for collective action by deepening cooperation among themselves in achieving the basic scientific objectives of the Institute.

- For the cultural activities of the Institute, the ISI Club, of which Professor Mahalanobis was President in the formative stage, has been also functioning as a unifying force, involving scientific and non-scientific workers, students and research scholars. Several functions, representing the depth of different dimensions of Indian culture, have been organized by the ISI Club over the last five decades.

16. PLATINUM JUBILEE CELEBRATION

- The Platinum Jubilee celebration of ISI will be inaugurated on 24th December, 2006, by Dr. Manmohan Singh, Hon'ble Prime Minister of India, in a solemn function at the headquarters of the Institute in Kolkata. Other dignitaries will include Shri Pranab Mukherjee, Hon'ble Minister of External Affairs, Government of India, as well as the Chairman of the ISI Council, Shri Buddhadeb Bhattacharjee, Hon'ble Chief Minister of West Bengal, Shri G.K. Vasan, Hon'ble Minister-in-Charge of Ministry of Statistics & P.I., Government of India, Professor C.R. Rao, FRS, National Professor and former Director of ISI, Professor A.P. Mitra, FRS, Chairman of the Section 8.1 Committee (Government of India), Professor J.K. Ghosh, former Director of ISI and former President of International Statistical Institute, and three other former Directors of ISI — Professors B.L.S. Prakasa Rao, S.B. Rao, and K.B. Sinha. Professor M.G.K. Menon, FRS, President of the Institute, will preside over the inaugural function, which will also include felicitation of the Hon'ble Prime Minister with honorary D.Sc. Degree of ISI. The foundation stone of the Platinum Jubilee Building will be laid by the Hon'ble Prime Minister on this auspicious occasion.
- The highlights of the major academic programmes, which will continue till the beginning of 2008, are given below:
    - 19 International Conferences, 8 National-level Conferences / Symposia / Workshops, and 13 Lecture Series will be organized, covering frontline research areas in seven scientific Divisions of the Institute.
    - Nobel Laureates, such as Professor Amartya K. Sen, Professor Robert J. Aumann, Professor Md. Yunus, Professor Robert Solow, Professor James Heckman, have been invited for delivering Special talks.
    - Special Lectures will also be addressed by major speakers such as Professor M.S. Swaminathan (National Professor), Professor Pranab Bardhan (Professor of Economics, University of California at Berkeley), Professor Tapan Raychoudhuri (Emeritus Professor of History, University of Oxford), Professor Andre Beteille (Chairman, Indian Council of Social Science Research). Special Lectures will also be organized in frontiers of science by Fellows of The Royal Society and other eminent scientists.
    - A commemorative volume on the landmarks of academic achievements of ISI during the last 75 years, including 87 rare photographs, and a special volume on the ISI Convocation Addresses (1962-2006) will be published.

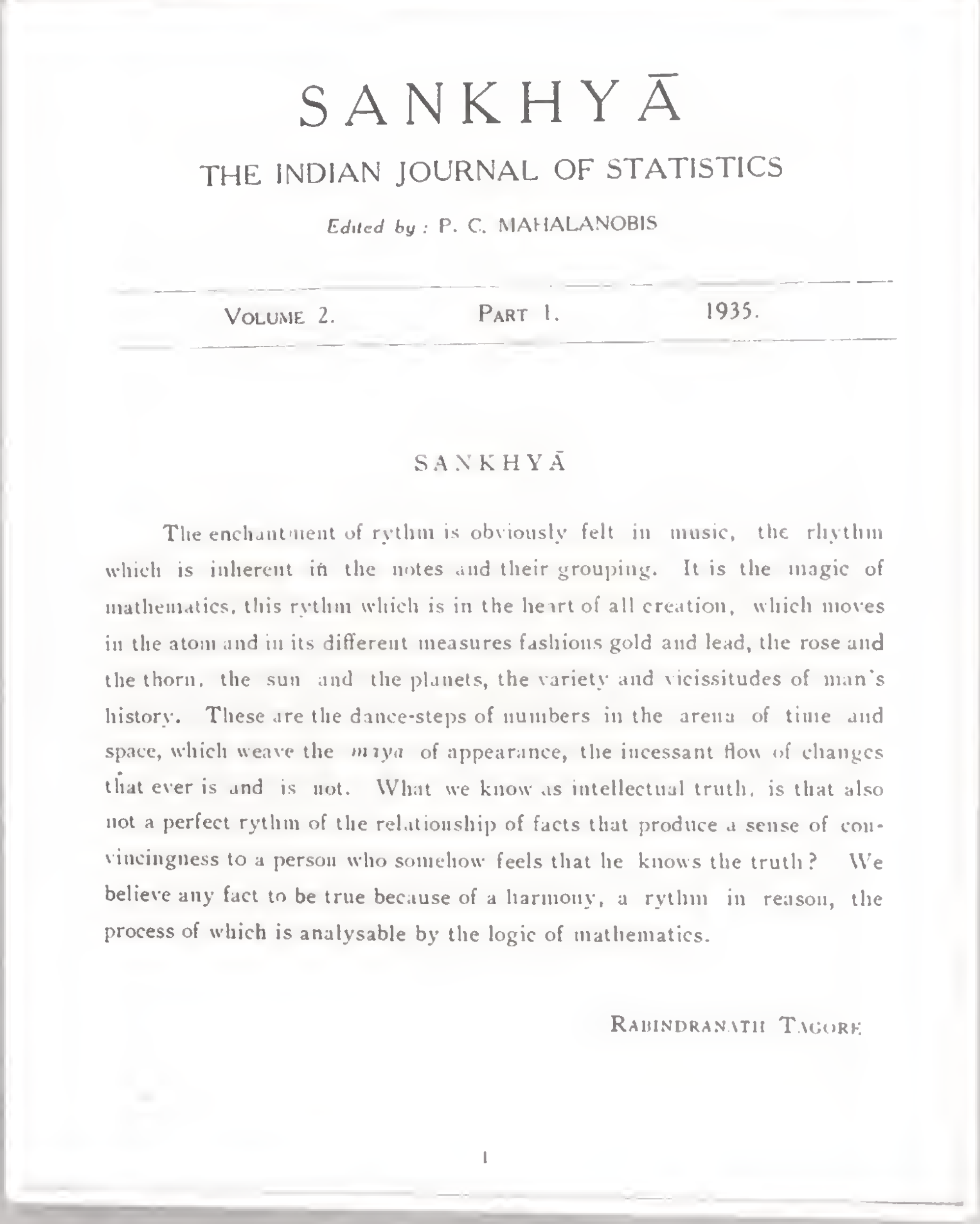
- The Platinum Jubilee volumes of the Institute will be published by World Scientific Press, Singapore, with Professor Sankar K. Pal, the present Dircetor, as series Editor and other eminent scientists as editors of individual volumes.
- The Platinum Jubilee Chairs will be instituted to invite eminent scientists from India and abroad, while the Platinum Jubilee fellowship will be given to promising young scientists.

17. TASKS AHEAD

For charting out the course of journey ahead, let us conclude with certain incisive observations of Professor C.R. Rao, which he submitted while delivering his special address, entitled 'Taming of Uncertainty,' at the Twenty-fourth Convocation of ISI on 29.12.1989. In this significant address, Professor Rao explicated: "in his book on Social Functions of Science, Bernal wrote in 1939, 'the work of the scientists has revolutionalised the modern world, but this happened not because but rather in spite of the character of the scientists themselves'. The message of Bernal's statement is that the scientists must improve their contact with the public and learn how to communicate science to the non-scientists. The Indian Statistical Institute, with its diversified interests and activities bound by the common thread of statistics, is in an ideal position to propagate statistical thinking among the public, the government and the scientists in other disciplines". Professor C.R. Rao concluded his speech with visionary remarks : "A country's biggest problem of the coming decades is not the challenge of war but of peace. The battle ground of the future is going to be economic and social welfare where we have to fight hunger and deprivation afflicting the society. We do not seem to be fully prepared for the attack. Our success will depend on acquiring and processing the information needed for optimum decision making by which the available resources, both in men and material, are put to maximum use for improving the quality of life of individuals. This has to be done in such a way that the progress is equitable and sustainable, with particular care to see that no irreversible damage is done to the biosphere. In achieving this revolution, statistics would be the key technology, a technology for shaping a new world through peace".

A view of Physics Laboratory, Presidency College, Calcutta, where ISI was founded on 17 December 1931.

Rajendra Nath Mukherjee (1854-1936) : The first President of the Institute. He held the position from 1931 till 1936



SANKHYĀ
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SANKHYĀ

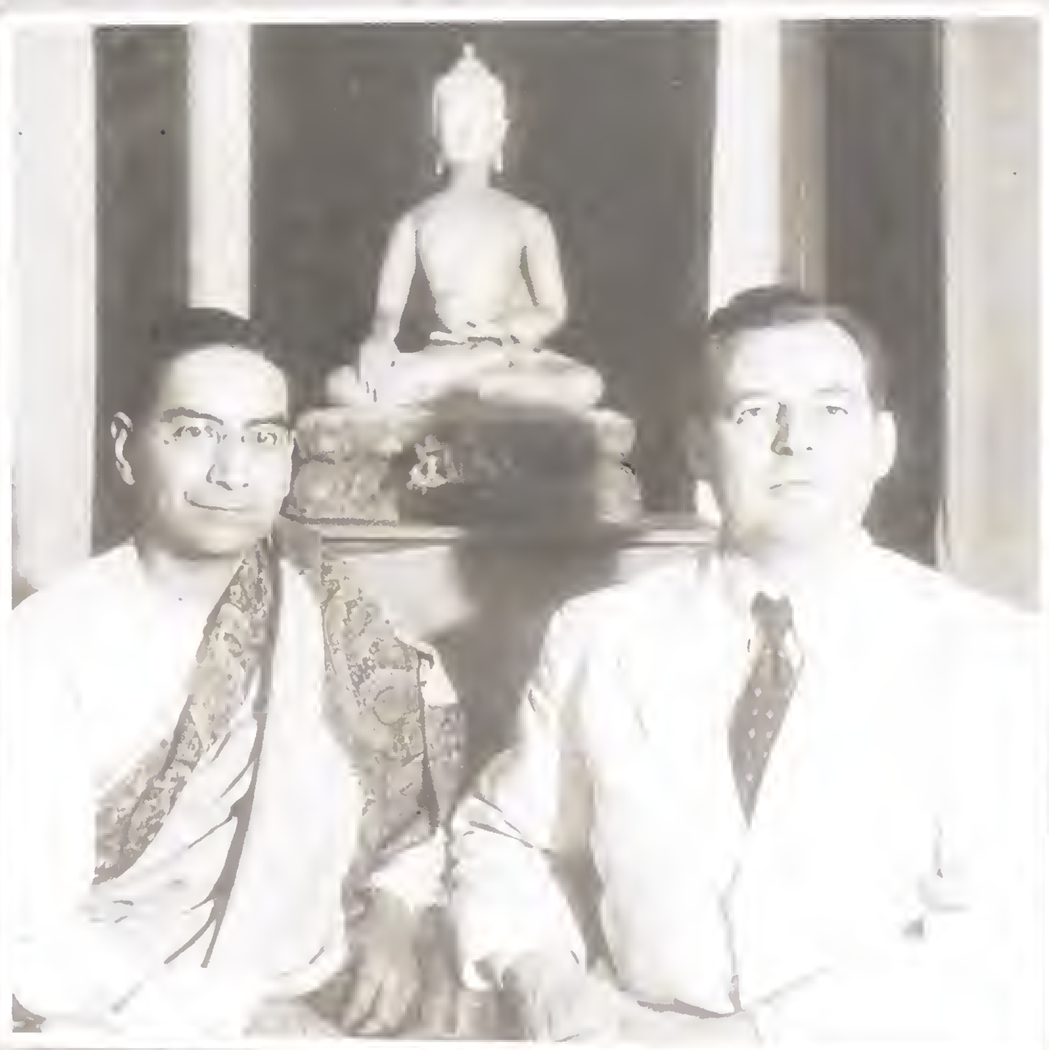
The enchantment of rythm is obviously felt in music, the rhythm which is inherent in the notes and their grouping. It is the magic of mathematics, this rythm which is in the heart of all creation, which moves in the atom and in its different measures fashions gold and lead, the rose and the thorn, the sun and the planets, the variety and vicissitudes of man's history. These are the dance-steps of numbers in the arena of time and space, which weave the *maya* of appearance, the incessant flow of changes that ever is and is not. What we know as intellectual truth, is that also not a perfect rythm of the relationship of facts that produce a sense of convincingness to a person who somehow feels that he knows the truth? We believe any fact to be true because of a harmony, a rythm in reason, the process of which is analysable by the logic of mathematics.

RABINDRANATH TAGORE

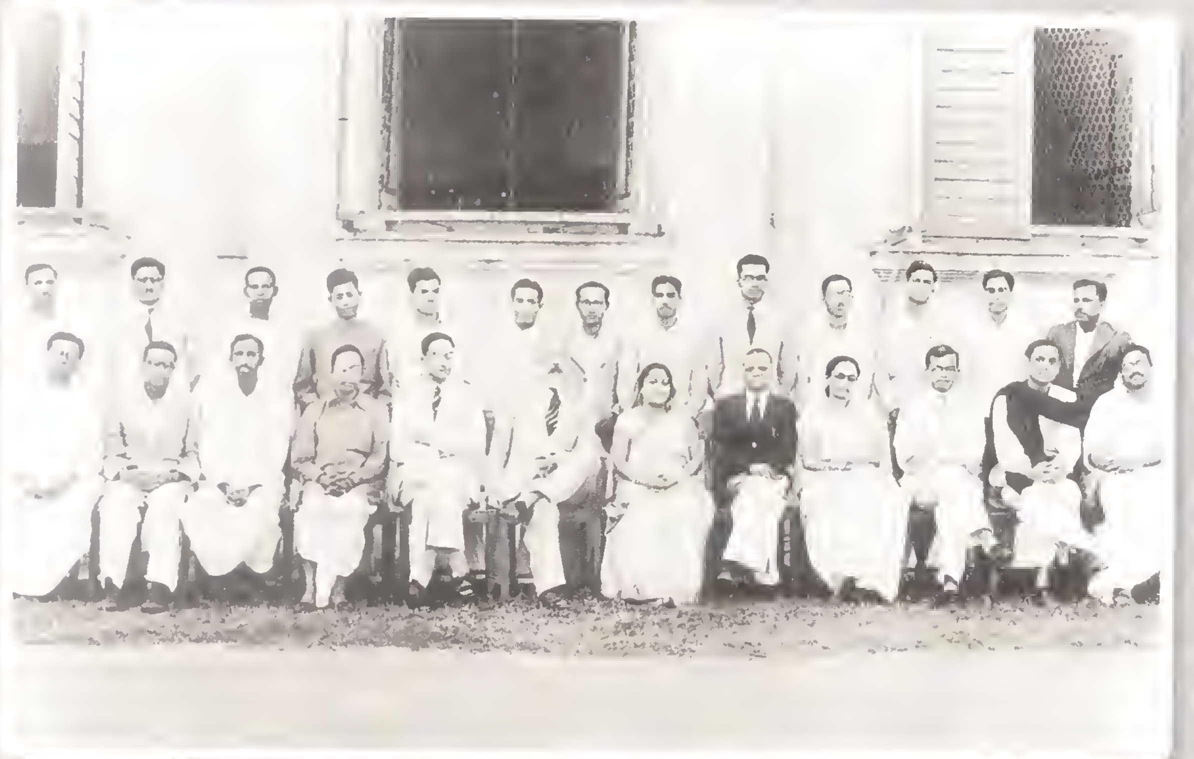
1

A message from Rabindranath Tagore for *Sankhya*, in *1935*

Mira Devi, Rabindranath Tagore, Prasanta Chandra and Nirmal Kumari Mahalanobis at 'Gupta Nivas' in 1938



P. C. Mahalanobis with Harold Hotelling at Gupta Nivas, 1939

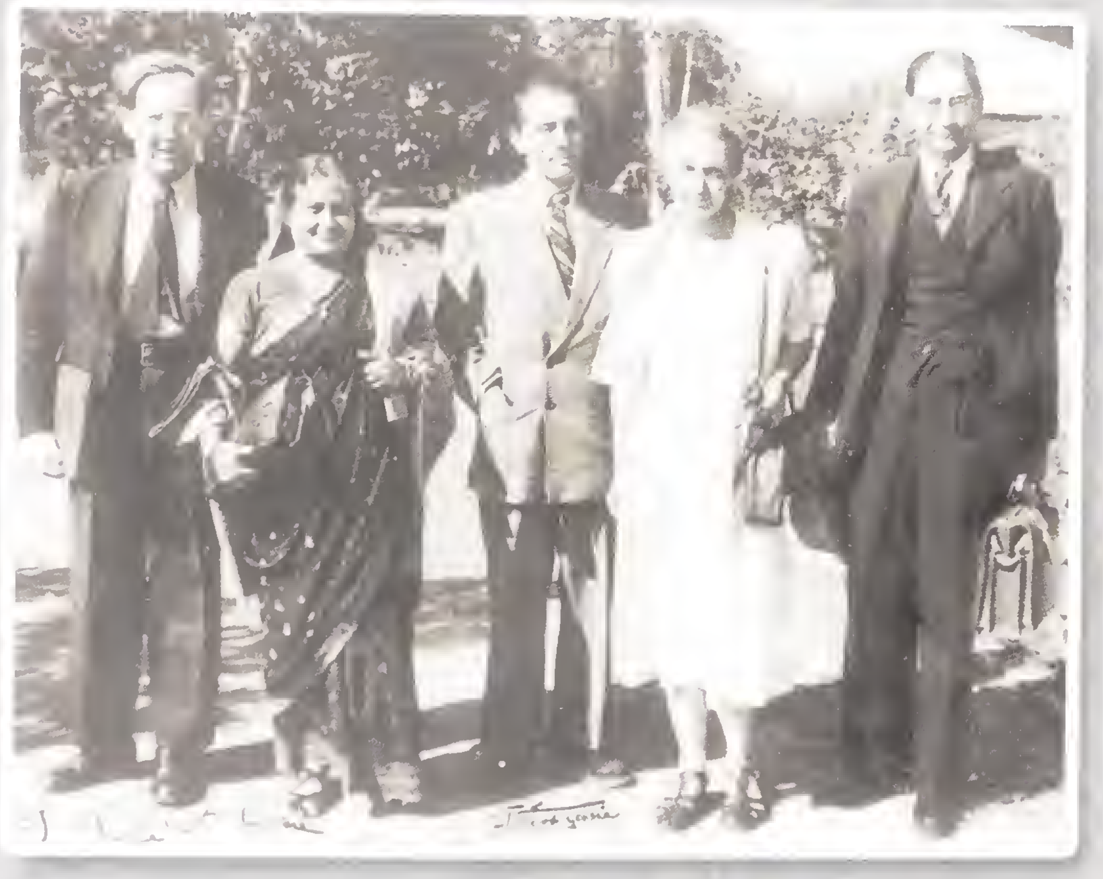


R.A. Fisher with the Institute workers during his visit to I.S.I., at the premises of Presidency College, Calcutta, 1945.

L to R (sitting): Samar Roy, Biren Ghosh, Sudhir Banerjee, R.C.Bose, P.C.Mahalanobis, R.A.Fisher, Nirmal Kumari, K.B. Madhava, Chameli Bose, N.T.Mathew, J.M.Sengupta and P.K.Bose.

Lto R (standing): H.Bhattacharyya, P.G.Banerjee,J.Sharma, N.C.Mukherjee, N.K.Chakravorty, R.P.Bhergava, S.Guha,C.R.Rao,M.N.Ghosh,H.K.Nandy,A.K.Gayen,K.C.Cheriyen and D.Ganguly.

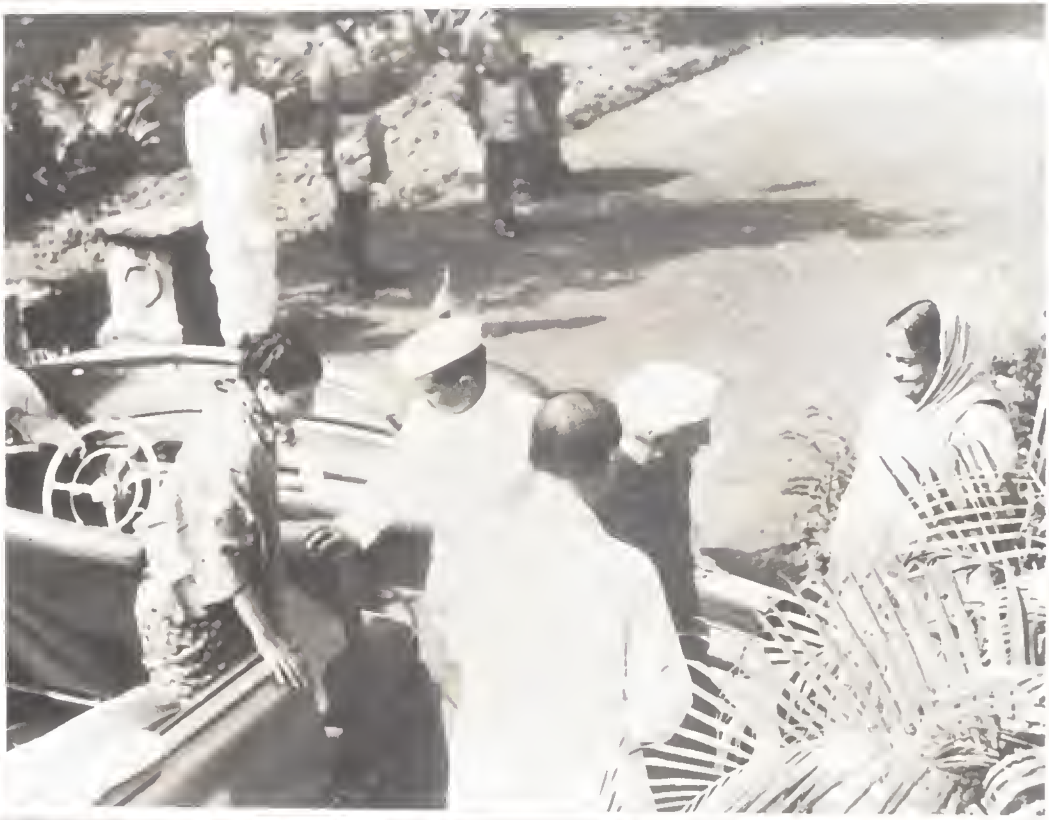
Prof. W. A. Shewhart delivering a lecture at I.S.I. in 1948. P. C. Mahalanobis was present along with other scientists



J.D. Bernal, Mrs. Mahalanobis, Frederic Joliot-Curie, Madame Irene Joliot-Curie and P.C. Mahalanobis, at ISI, January 1950

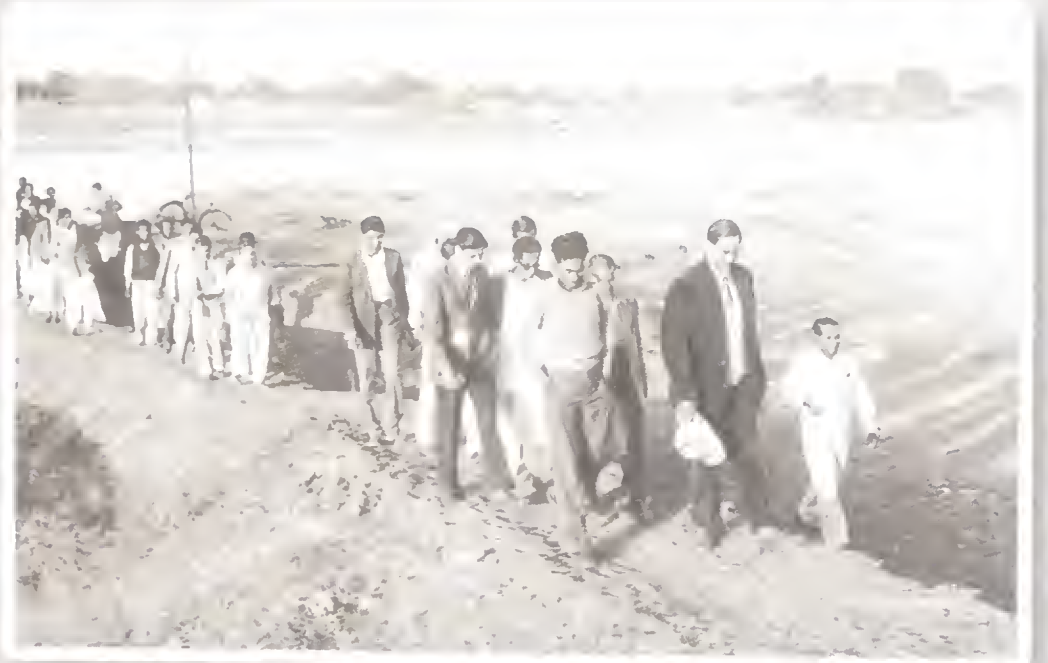
Rajendra Prasad, President of India, speaking at the inauguration ceremony of the International Statistical Conference, Rastrapati Bhavan, New Delhi, 5 December, 1951, in presence of P. C. Mahalanobis

R. A. Fisher and the delegates of the International Statistical Conference visiting a sample village Nahazari, 24 Parganas, December, 1951

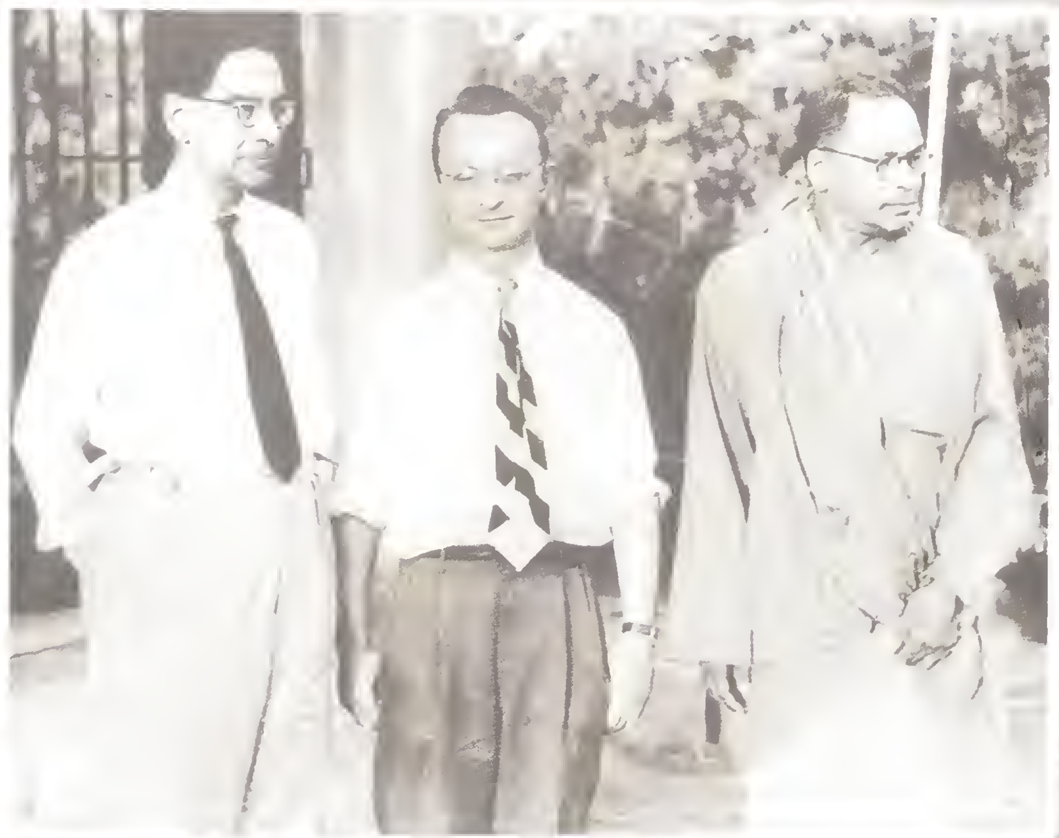


P.C. Mahalanobis & Mrs. Mahalanobis receiving Pandit Jawaharlal Nehru & Smt. Indira Gandhi at Amrapali, in ISI, December 13, 1953

P. C. Mahalanobis and Nirmal Kumari Mahalanobis with the workers in Giridih Branch, in 1953



Professor P. C. Mahalanobis in a field visit in Giridih Branch, in 1953



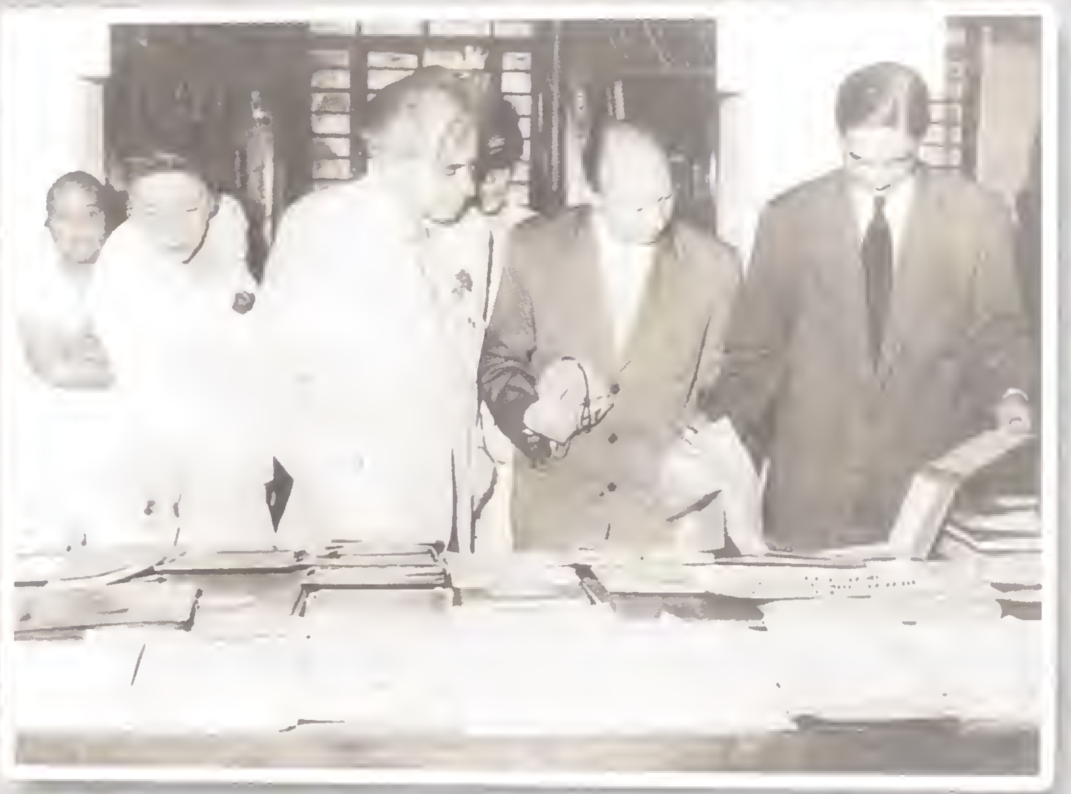
P. C. Mahalanobis with Professor Haris and Meghnad Saha at Amrapali, in ISI, in 1953

Norbert Wiener and Mrs. Wiener at the Institute in January, 1954

Pandit Jawaharlal Nehru, Prime Miister of India, inaugurating studies on national planning at I.S.I., Calcutta, on 3 November 1954

P. C. Mahalanobis with the statisticians of C. S. O. during a reception at his New Delhi residence, 8 King George Avenue, 3 December, 1954

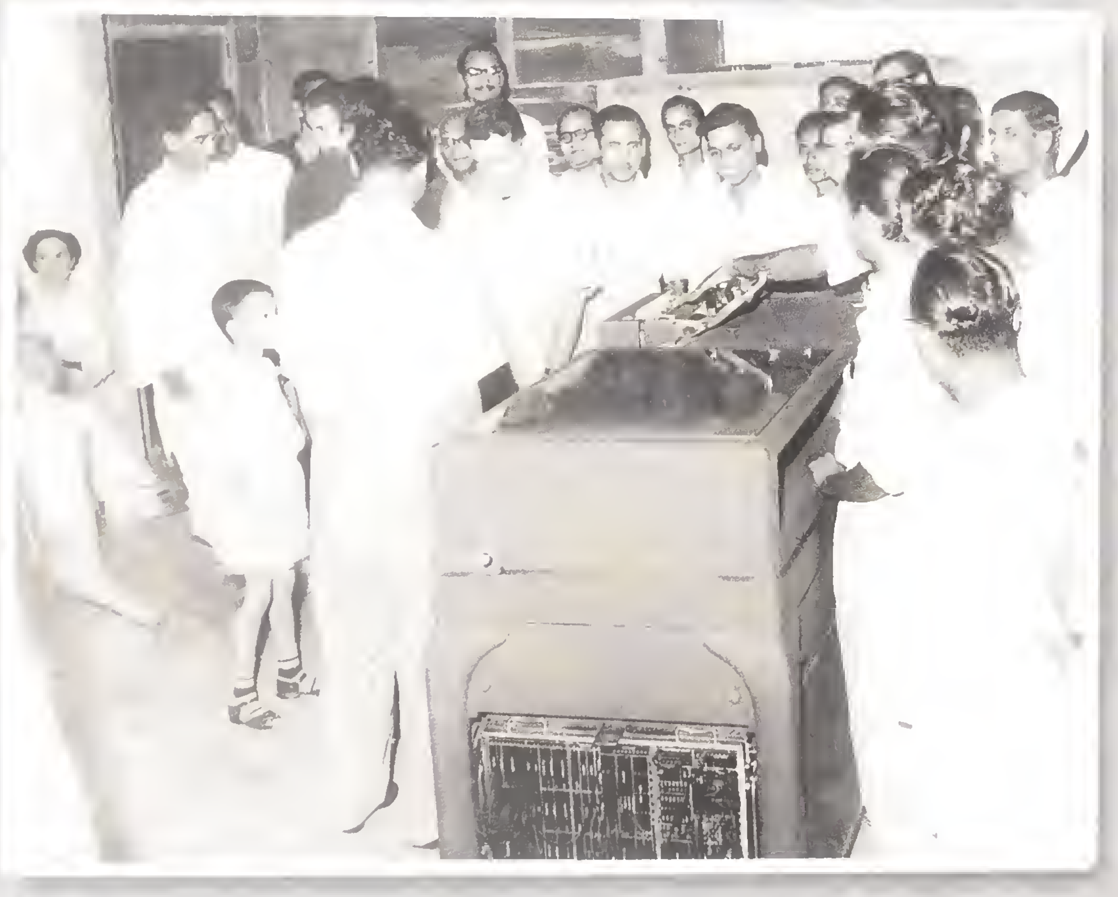
Farewell party to G. Taguchi, sitting on his side P. C. Mahalanobis and Mrs. Mahalanobis at I.S.I., in 1955



P.C. Mahalanobis & Mrs. Mahalanobis with Charles Bettelheim, and Russian novelist Ilya Ehrenburg and Mrs. Ehrenburg at ISI, Calcutta, on 31st January, 1956

P.C. Mahalanobis and P.N. Bannerjee at the farewell to Jan Tinbergen, Nobel Laureate in Economics, J. Links of the Central Planning Bureau, The Hague, Holland, and Titus Podea, Consultant, Operational Planning, New York - at the ISI, February 13, 1956

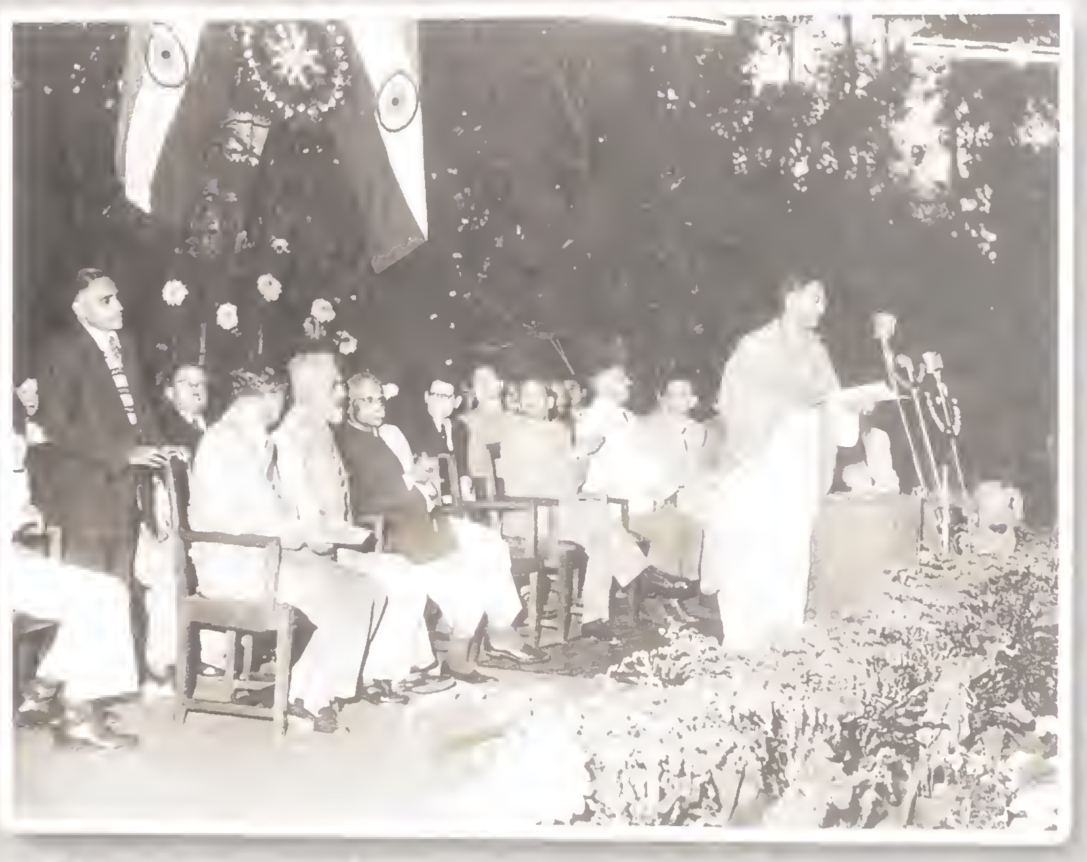
Oscar Lange, Chairman, Economic Council, Rector, Institute of Statistics and Planning, Warsaw and Mrs. Lange with P. C. Mahalanobis at their farewell in I.S.I., 10th March, 1956



P.C. Mahalanobis at the installation ceremony of a Russian Computer at the Institute, 2 April, 1956

United Nations Statistical Commission, New York, 16 April - 3 May, 1956, with P. C. Mahalanobis in the chair

P. C. Mahalanobis and C. D. Deshmukh discussing at Amrapali in ISI, in 1956

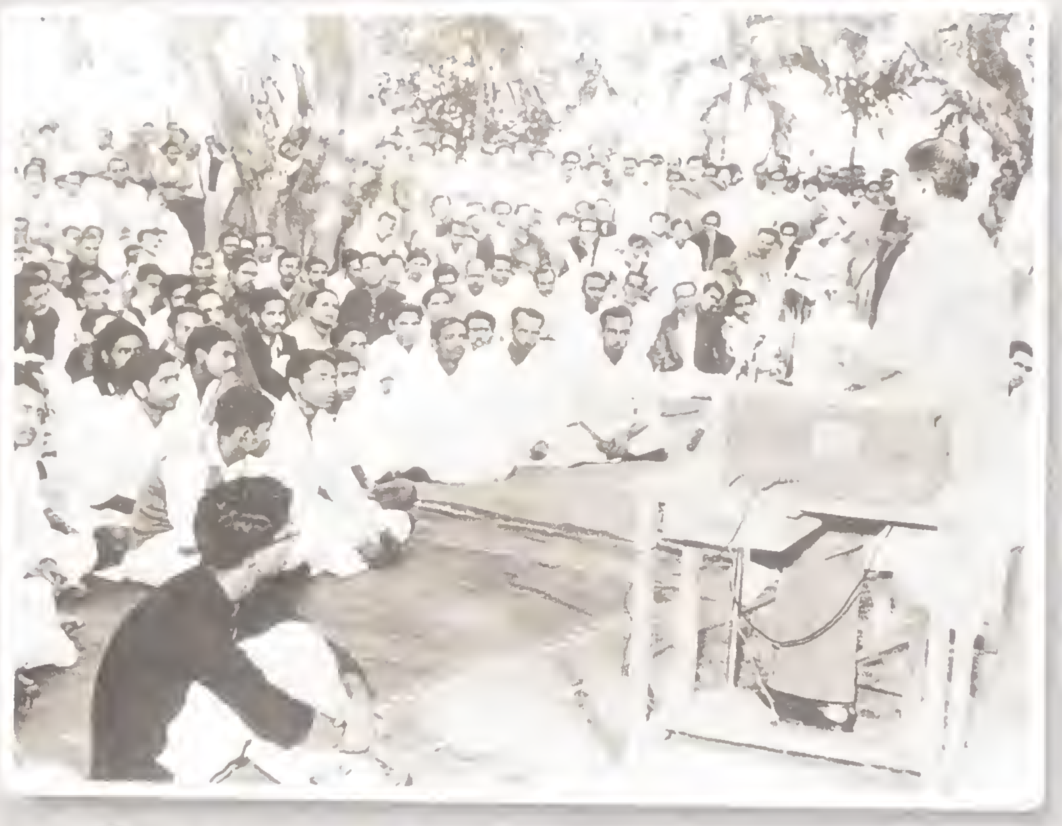


P. C. Mahalanobis speaking at the 25th Anniversary Celebration of the Indian Statistical Institute, 17 December, 1956. R. A. Fisher was on dais, along with other dignitaries

Wang Szu Hua, Deputy Director, Central Statistical Board, China, T. Kitagawa, Kyushu University, Japan, J.S. Neyman, Chairman, Berkley University, USA and othersin a steamer journey across the Ganges near Calcutta, in 1956

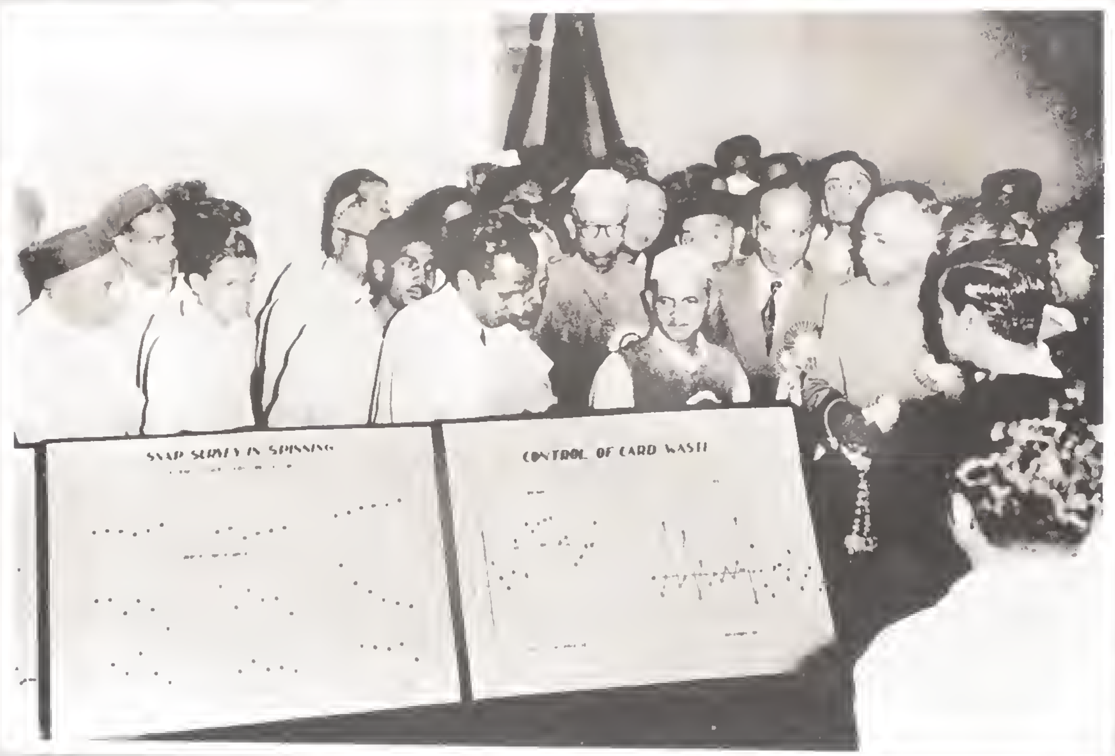
Chou-en-Lai, Prime Minister of China, visiting ISI with P. C. Mahalanobis, in December 1956

J. B. S. Haldane on his birthday with P. C. Mahalanobis at Amrapali, 5th November, 1957

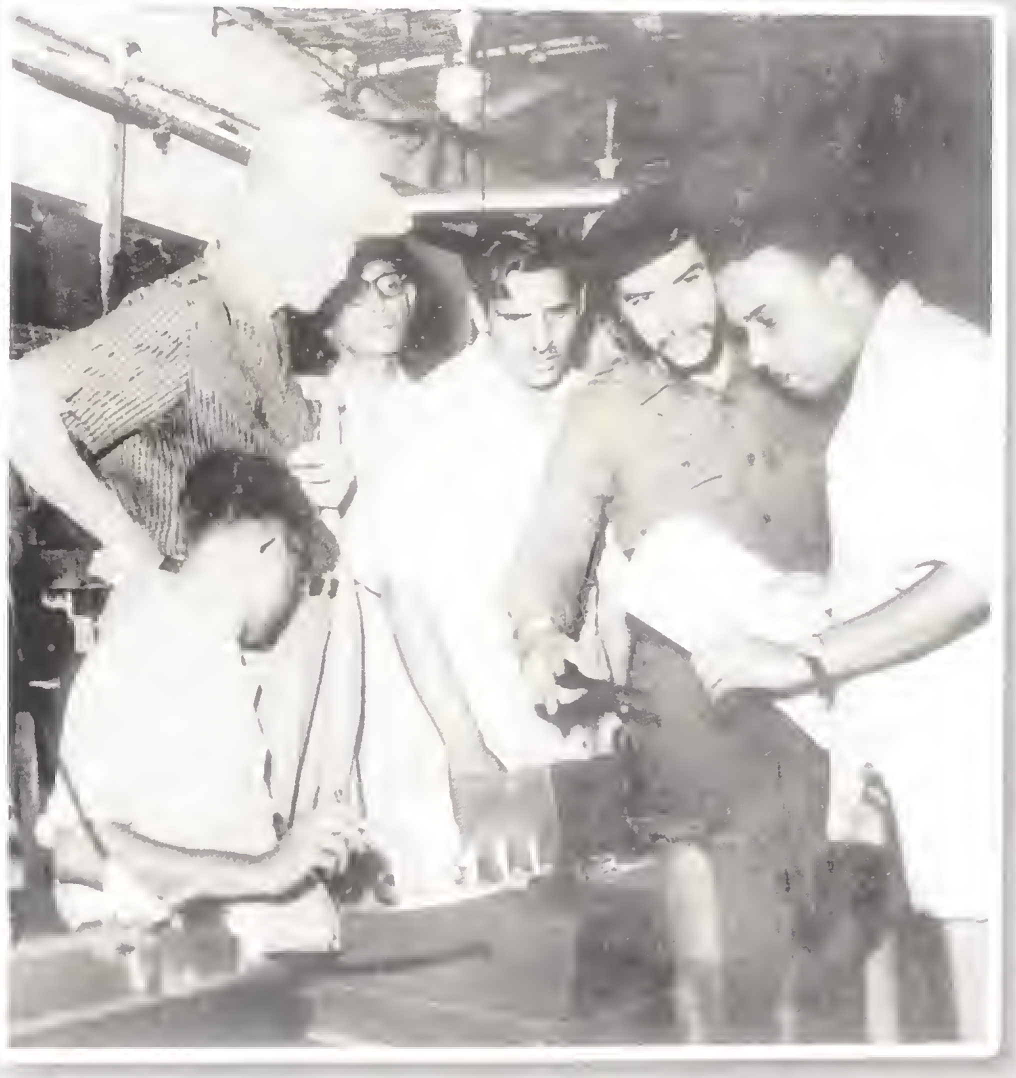


P. C. Mahalanobis (sitting on table) speaking to ISI workers in 1957

P. C. Mahalanobis with Ho Chi Minh, President of the People's Republic of Vietnam, in ISI, February 13, 1958

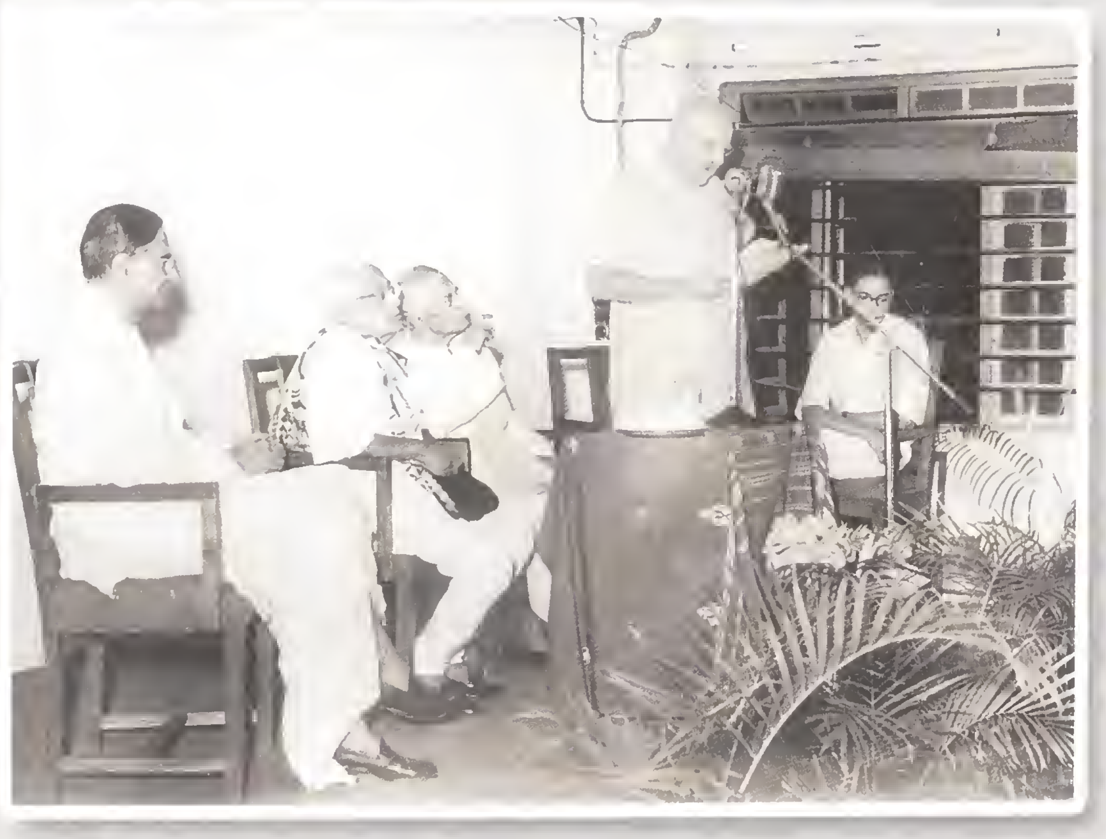


Lal Bahadur Shastri, Minister for Industries & Commerce and later Prime Minister of India, at an Industrial Exhibition organised by ISI, S.Q.C. Unit, Bangalore, May 1959

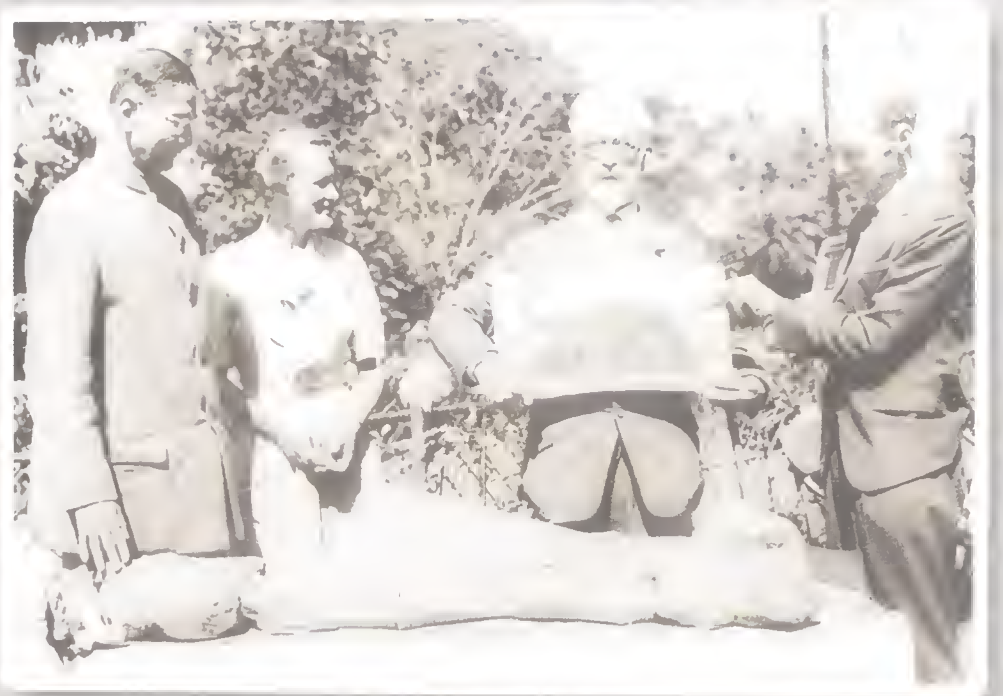


Che Guevara, leader of a Cuban delegation visiting ISI, July 10, 1959

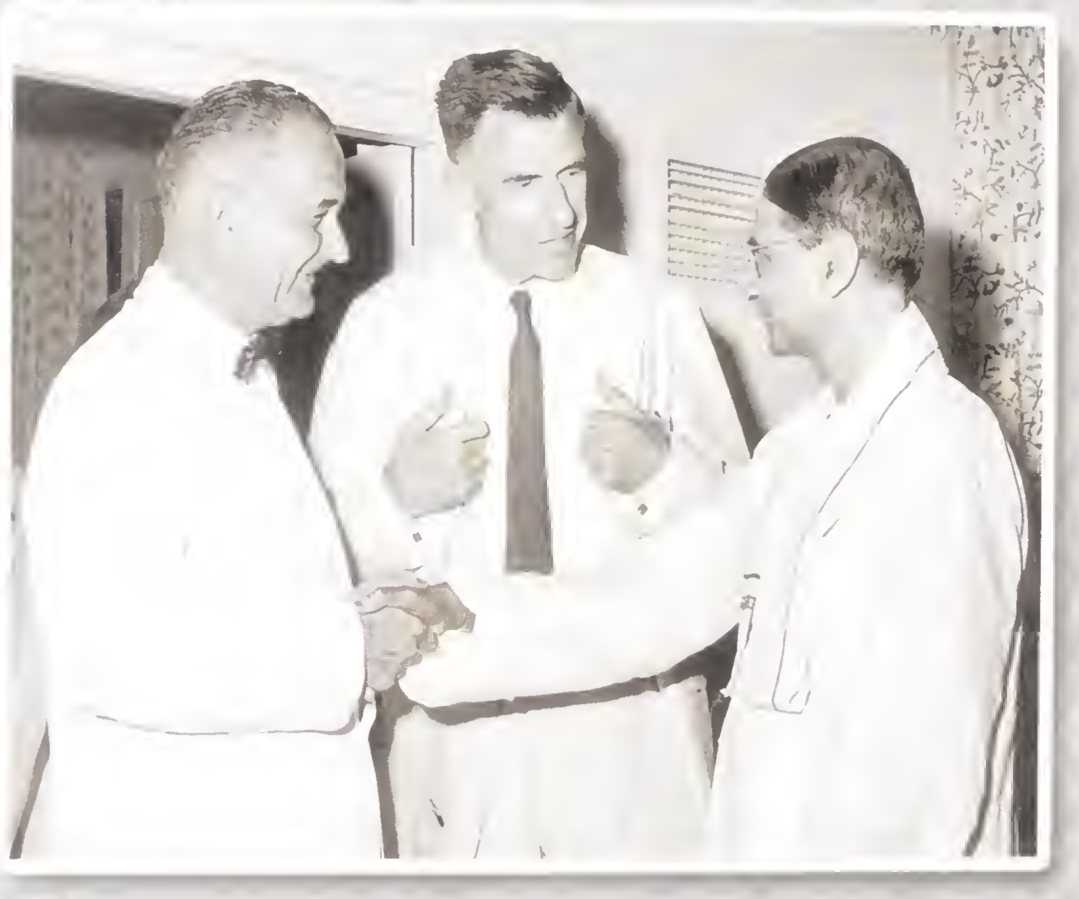
Niels Bohr, Nobel Laureate, Director, Institute of Theoretical Physics, Copenhagen, with P.C. Mahalanobis at the ISI, 16th January, 1960



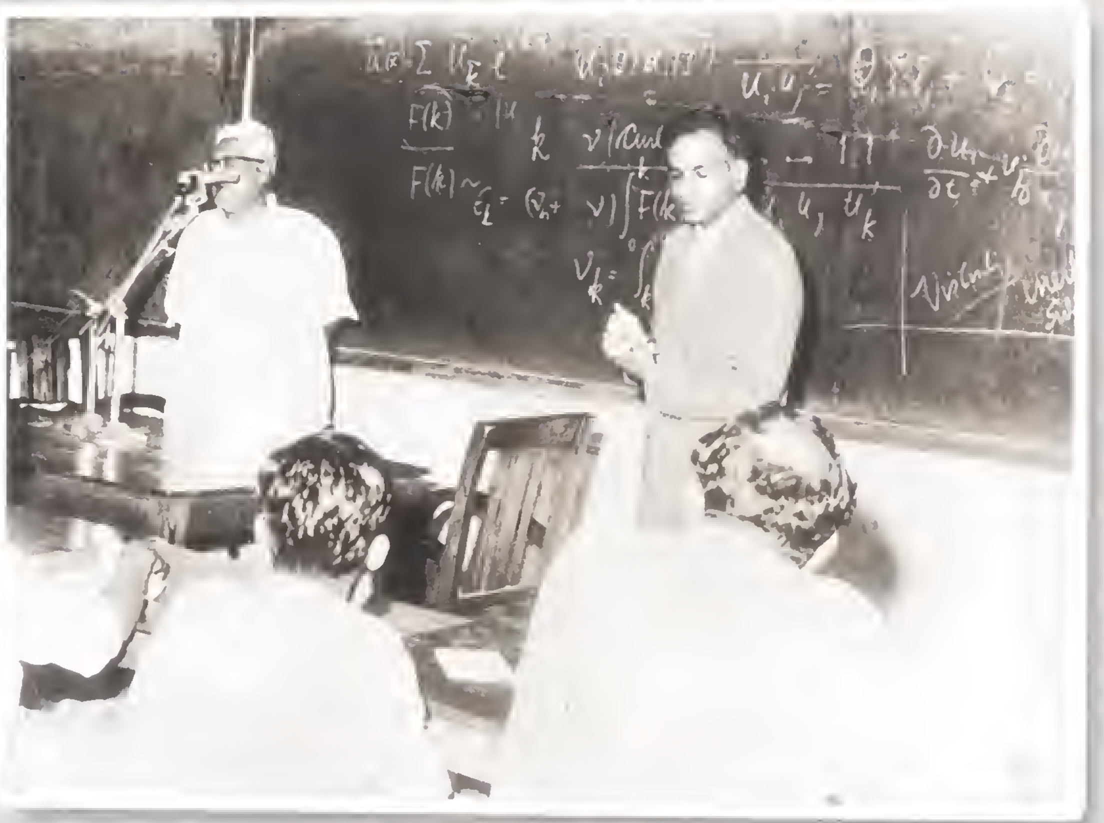
J. B. S. Haldane speaking at the degree course opening ceremony at the Institute, 16 August, 1960 in the presence of P. C. Mahalanobis, S. N. Bose and C. R. Rao



(From left to right) - P. C. Mahalanobis, Pamela L. Robinson, R. A. Fisher (showing picture of a dinosaur) and Alec Smith standing in front of fossil bones of dinosaurs excavated by the ISI team, on 11 February, 1961

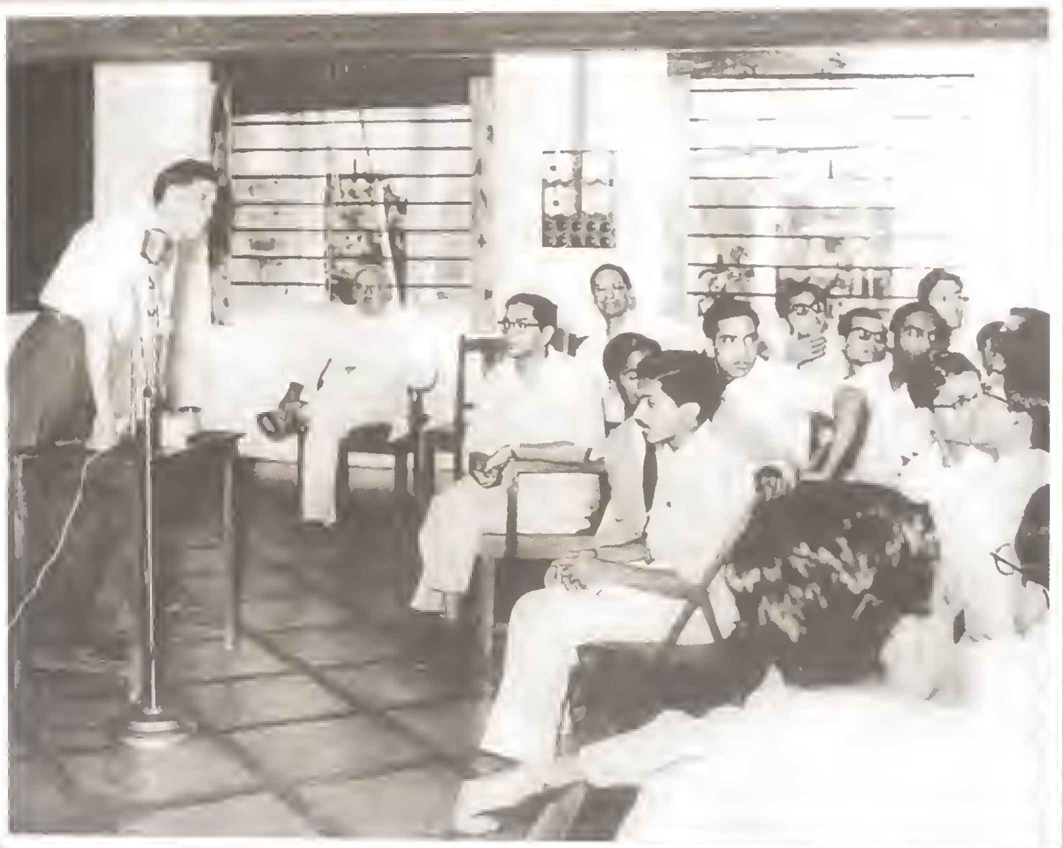


P. C. Mahalanobis with J. K. Galbraith, U. S. Ambassador to India, and L. B. Johnson, then Vice President of the USA in New Delhi, May 20, 1961



S. N. Bose, FRS, addressing a gathering during the visit of S. Chandrasekhar, FRS, Sept 18, 1961.

A. Kosygin, first deputy chairman, USSR Council of Ministers, with Pandit Jawaharlal Nehru and P. C. Mahalanobis 1961



Lord P.M.S. Blackett, Nobel Laureate,and President of the Royal Society, P.C. Mahalanobis, J.B.S. Haldane and C.R. Rao at ISI, Calcutta, in 1962

P. C. Mahalanobis addressing the first Convocation of I.S.I, 12 February, 1962

R. A. Fisher receiving the Honorary degree of Doctor of Science of the I.S.I. from K. B. Madhava, on 12 February, 1962

Academician A. N. Kolmogorov, S. N. Bose, P. C. Mahalanobis at a Special Convocation held to confer Honorary degree of Doctor of Science of the I.S.I. to Kolmogorov on 28 April, 1962

Joan Robinson, University of Cambridge, delivering a lecture at the ISI, November 25, 1964

DRTC Seminar (3) 1965
Depth Classification : Subject Headings in Bangalore

Siting: (Ground) (L to R) Sriyuths Narasimha Iyengar (MR), Mrs. Kalyani Subbarao (CV), Miss. Ramani (KS), Miss. Nadgir (GB), Mrs. Goonetileke (SC) Miss. Ghare (K), Miss. Saradambal (S), Miss. Sugra Begum (R), Jain (TC)
Sitting: (L to R): Sriyaths Nagarajan (KS), Zaidi (ZKR), Shah (PR), Saha (J), Mrs. Maya Bhattacharya, Mrs . Saha (J), Palmer (BI), Ranganathan (SR), Mrs. Ranganathan (SR), Mrs. Neelameghan (A), Raja, Neelameghan(A), Mrs Gorja Kumar, Kaula (PN). Bagari (ND)
Standing:(1st Row: ' (L to R): Sriyuths Rau (MVR), Subbarao (K), Sampath (HK), Srinivasan (V), Sangameswaran (SV), Ahmed Sultan, Subba Rao (CV), Goil (NK), Chakraborthy (AK), Parthasarathy (VV), De Sarkar, Pandid (SP), Nair (VKG), Anjaneyulu (V), Venkatachalappa (KV)
Standing 2nd Row:. (L to R) Sriyuths Krishna (V), Gopal Shenoy (V), Rajappa (BV), Phadnis (SP), Girja Kumar, Subramanyam (TV), Amarnath (K), Seshadri (SR),Raghavandra Rao (GS), Raja Rao (D Ch.), Gosh (GB), Bhide (MG), Vasudeva Rao (KN), Sridhara (KR), Ramananda (BS), Krishnan
Standing: 3rd Row (L to R): Sriyuths Nagappa, Chikkaiaha (C), Mohan Bhatia, Krishnaprasad (LR), Gupta (AK), Bhattacharyya (G), Wasan (RP), Gupta (SR),Gopinath (MA), Sethama (S), Anantharamaiaha (HV), Sastry (KC), Subramanian (PVS), Mukerji (SC), Govindiah.

P. C. Mahalanobis at the ISEC Convocation, on 12 April, 1965

R.L.N. Synge, FRS, Nobel Laureate in Chemistry, delivering a lecture at the Institute, April 20, 1965

M. C. Chagla, Union Minister of Education, at the inaugural ceremony of ISIJU-1 Computer, 2 April, 1966

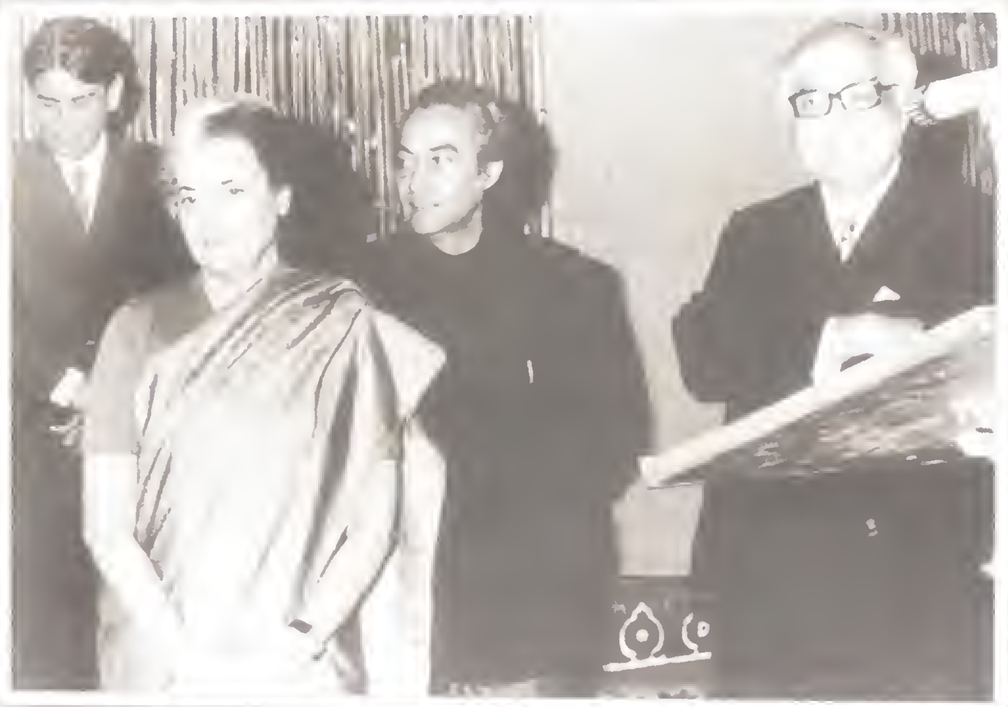
Suniti Kr. Chatterjee, National Professor, Academician Djordje Kostic, Director, Institute of Experimental Phonetics & Speech Pathology, Bel grade, P.C.Mahalanobis and C.R. Rao, at an International Seiminar on Bengali Acoustic Phonetics at I.S.I., Feb 19-20, 1969

P. C. Mahalanobis and Mrs. Mahalanobis with Professor and Mrs. Romar in 1971

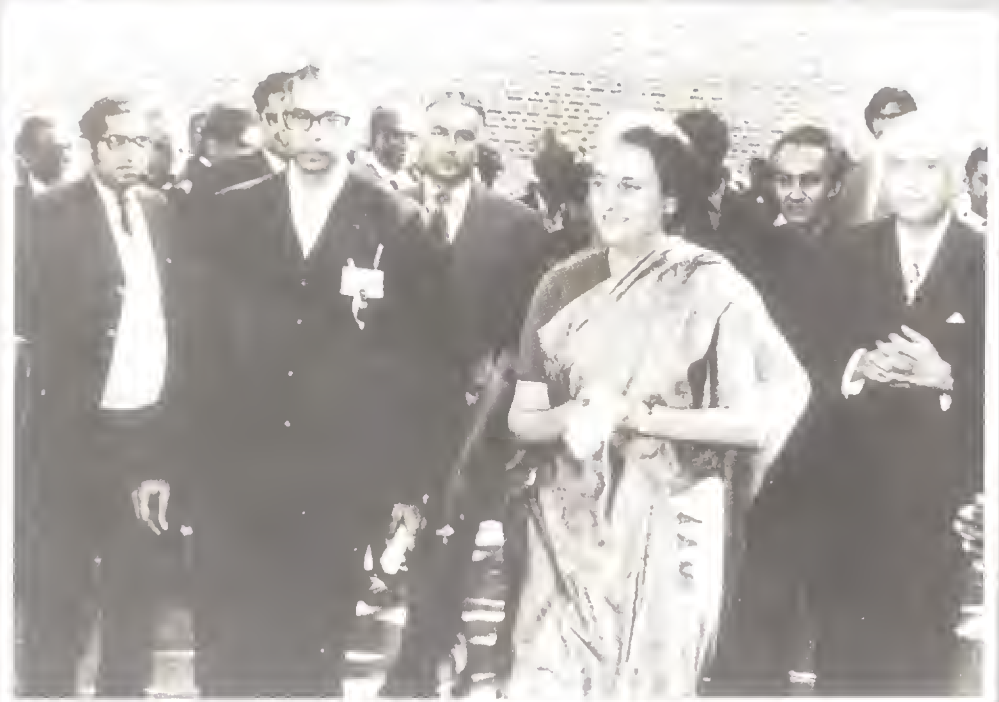
Prof. Sukhamoy Chakraborty speaking at a seminar in Delhi campus of ISI in December 1974 in the presence of P. N. Haksar and C. R. Rao

Prof. C. R. Rao presenting a gold medal to felicitate Prof. Sukhamoy Chakraborti in the Delhi campus of ISI in December 1974

Special Convocation to confer the Honorary D. Sc. Degree on Academician M. V. Keldysh, Professor J. Neyman and Professor R. C. Bose (speaking) held on 18.12.74 (Academician Keldysh was awarded the degree in absentia). Others dignitaries sitting on the dais are Shri P. N. Haksar, Professor C. R. Rao and Professor Moni Mukherjee.



Smt. Indira Gandhi, Prime Minister of India, inaugurating the Delhi campus (subsequently a centre) of ISI, in the presence of P. N. Haksar, Chairman of the ISI council, on 31 December 1974. Prof. B. S. Minhas was also present



Smt. Indira Gandhi, Prime Minister of India, inaugurating the Delhi campus (subsequently a centre) of ISI, with P. N. Haksar, Chairman of ISI Council, and C. R. Rao, Director of ISI, on 31 December 1974

Prof. Harod Cramer with Prof. G. Kallianpur and Prof. C. R. Rao in ISI in 1977

Prof. Nripen Bandyopadhyay addressing the meeting of ISIWO convened on 29th June, 1977 to observe the birthday of P. C. Mahalanobis. Prof. G. Kallianpur, Prof. Ambarish Ghosh, Dr. Atis Dasgupta and Shri B. Chatterjee, along with other members of ISIWO, were also present

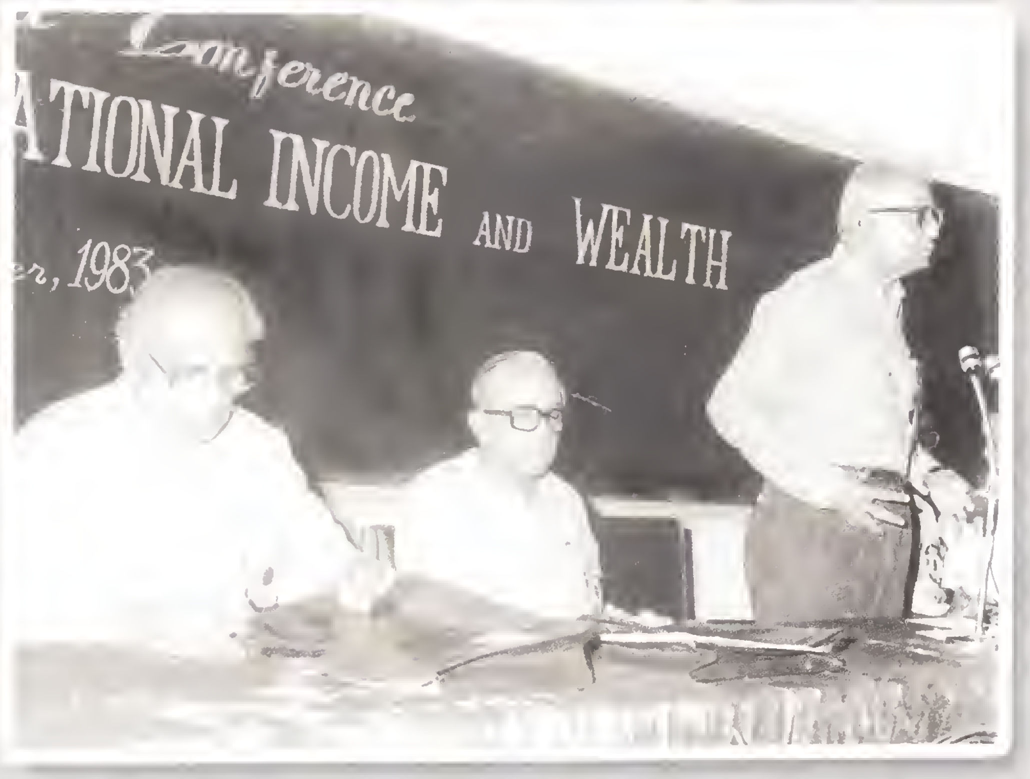
Shri Morarji Desai, Prime Minister of India, delivering Convocation Address. Prof. G. Kallianpur, Director, Shri P. N. Haksar, Prof. J. Roy and other dignitaries are seen in the picture, 7th February, 1978

Smt. Indira Gandhi, Prime Minister of India, with Prof. B. P. Adhikari, Director, during the inaugural function of the Golden Jubilee Celebration of ISI, 29th January, 1982

Smt. Indira Gandhi, Prime Minister of India, delivering her speech on the occasion of Golden Jubilee Celebration of the Institute in Calcutta. Prof. C. R. Rao and Prof. Kallianpur are on the dais along with others, 20th January 1982

Inaugural function of the Golden Jubilee Celebration of I.S.I. 29th January, 1982 Smt. Indira Gandhi Prime Minister of India, is on the dais, along with Shri Subimal Dutta, President of I.S.I.Shri P. N. Haksar, Chairman of I.S.I. Council, Prof. C.R. Rao, Prof. G. Kallianpur, Prof. B. P. Adhikari, Director of I.S.I. and other dignitaries

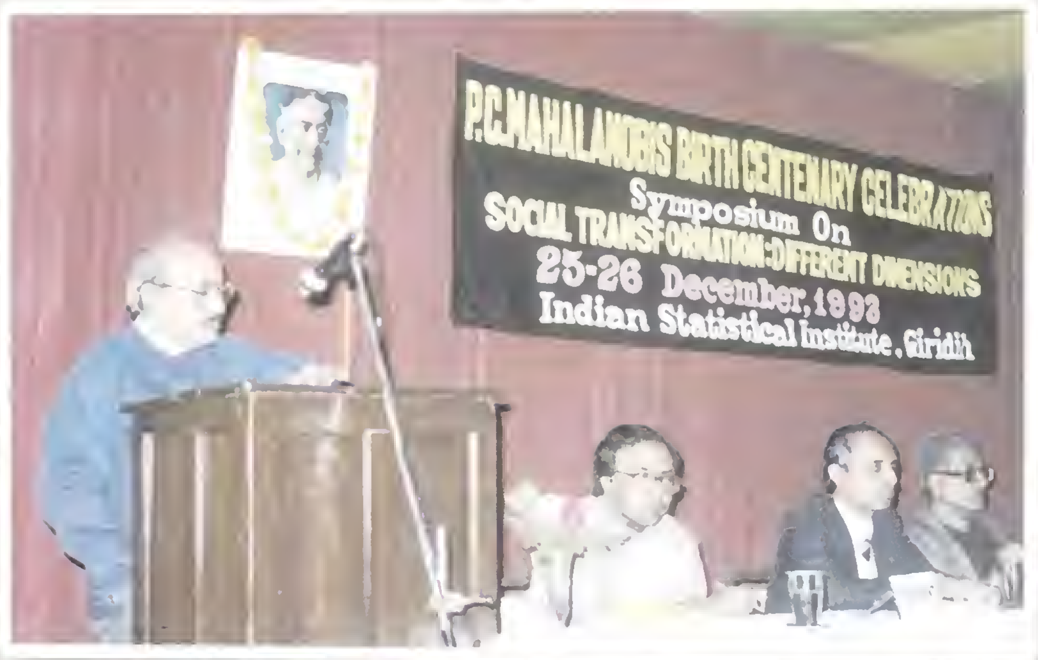
Prof. B. P. Adhikari, Director, delivering his speech. Sitting on the dais Subimal Dutta, President, P. N. Haksar, Chairman, and Prof. Sukhamoy Chakraborty, during 17th Convocation of I.S.I., 28.02.1983



Shri P. N. Haksar, Chairman of the ISI Council, and Shri Jyoti Basu, Chief Minister of West Bengal, are sitting on the dais in the inaugural function of conference on Indian Association for Research in National Income and Wealth at I.S.I. in 1983

Prof. Ashok Maitra, Director of I.S.I., speaking at the P. C. Mahalanobis Memorial Lecture. Sitting on the dais are Shri P. N. Haksar and T. N. Anduras, on 9th December, 1985

(From L to R) Prof. B. L. S. Prakasa Rao, Director, ISI, Shri P. N. Haksar, Chairman, ISI, Shri Giridhar Gomango, Minister of State for Planning and Programme Implementation, Prof. M. G. K. Menon, President, ISI, Shri P. V. Narashimha Rao, Prime Minister, Shri Jyoti Basu, Chief Minister, West Bengal. Shri Pranab Mukherjee, Minister of Commerce & Vice-Chairman, Planning Commission, Shri Sukh Ram, Minister of State for Communication at the inauguration of Birth Centenary celebration of P. C. Mahalanobis on 29 June 1993


P.C.MAHALANOBIS BIRTH CENTENARY CELEBRATIONS
Symposium On
SOCIAL TRANSFORMATION:DIFFERENT DIMENSIONS
25-26 December,1993
Indian Statistical Institute, Giridih

Professor Bikas Sinha (now member of National Statistical Commission) delivering his address at the symposium in Giridih Branch in 1993. Prof. Barun De and other speakers were also on the dais

Designed by Repro & Photo Unit, ISI Kolkata

P.C.MAHALANOBIS BIRTH CENTENARY CELEBRATIONS
Symposium On
S NSFORMATION:DIFFERENT DIMENSIONS
mber,1993
tical Institute, Giridih

Professor Andre Beteille (Chairman, ICSSR), delivering his lecture at P. C. Mahalanobis Birth Centenary celebration at the symposium on social transformation in Giridih branch in 1993. Professor B. L. S. Prakasa Rao, Director of ISI, was on dais

A discussion in the midst of the symposium at Giridih in 1993 : (from L) : Prof. Barun De, Prof. Suraj Bandopadhyay, Prof. Sushil Mukherjee and Prof. B. L. S. Prakasa Rao, Director

Designed by Repro & Photo Unit, ISI Kolkata

Professor S. B. Rao, Director of ISI, addressing the 33rd Convocation of ISI in Kolkata, 22 February 1999, with Professor M.G.K Menon, President of ISI, on the dais

Prof. Amartya K. Sen, Nobel Laureate delivering lecture at I.S.I; sitting on the dais (L to R) : Prof. Atis Dasgupta and Prof. Kalyan Bidhan Sinha, Director, I.S.I., on 3rd January, 2001

Designed by Repro & Photo Unit ISI Kolkata

President Abdul Kalam entering the 1st gallery of the P. C. Mahalanobis Museum & Archives with Governor Viren J. Shah, Prof. M. G. K. Menon, Prof. G. M. Saha, Prof. Atis Dasgupta and Sm. Krishna Bhattacharya, at Amrapali on 27th February, 2004

A moment in President Abdul Kalam's Convocation Address at the Institute in Calcutta on 27th February, 2004

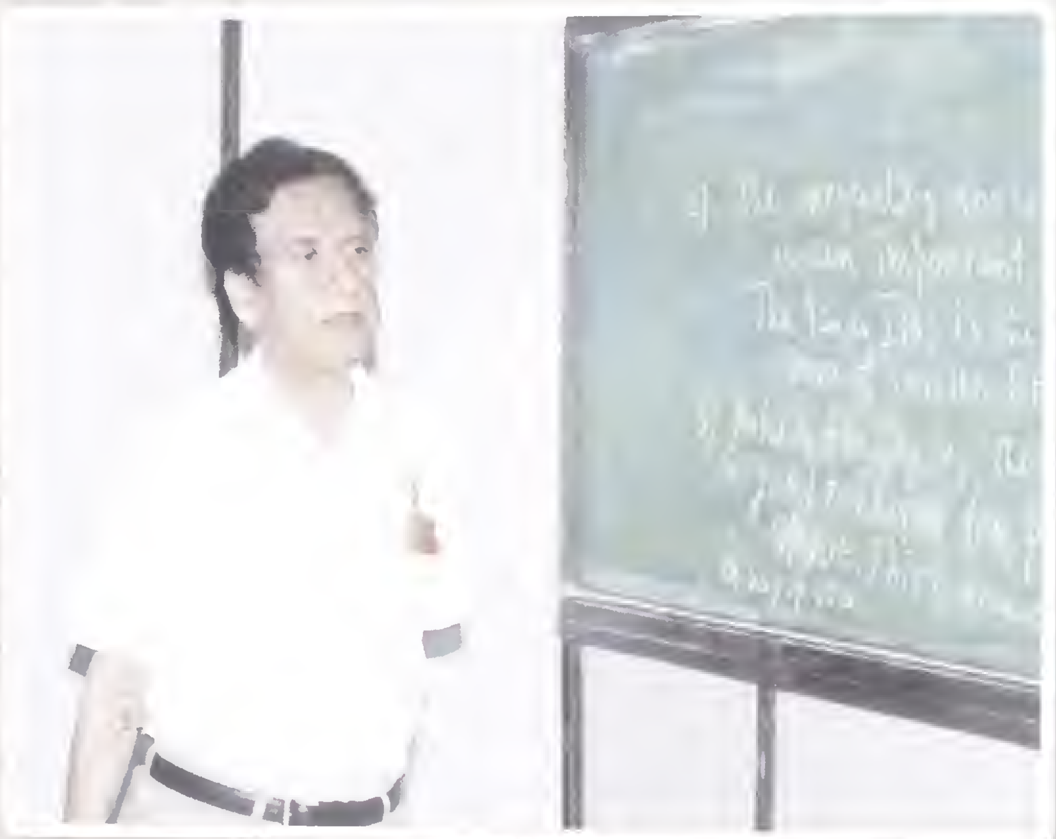
Shri Pranab Mukherjee, Chairman of the ISI Council, reading the write-up on the rare drawing of Nandalal Bose in the P. C. Mahalanobis Museum at Amrapali, ISI, 17th January, 2005

Shri Pranab Mukherjee, Chairman of the ISI Council, having a discussion in Amrapali, after unveiling the restored rare painting of Nandalal Bose. Professor Deb Kumar Bose, Shri Ramananda Bandyopadhyay, eminent artist, Dr. S. K. Basu (Director, Indian Museum), Dr. Ashok Bhattacharya (Member, Trustee Board of Indian Museum), Professor Partha Pratim Majumder, Professor Atis Dasgupta and others were present in the discussion, 17th January, 2005

Shri Gopal Krishna Gandhi, Governor of West Bengal, and Prof. M. G. K. Menon, President of ISI, taking a close look at the display of archival documents in P. C. Mahalanobis Museum & Archives. Sm. Krishna Bhattacharya was also present. 18th March, 2005

Shri Buddhadeb Bhattacharjee, Chief Minister of West Bengal speaking at the International Conference on Pattern Recognition and Machine Intelligence at I.S.I. on 18th December, 2005 Prof. S. K. Pal, Director, Prof. M. Kundu and Prof. C. A, Murthy are on the dais

Prof. S. K. Pal, Director and Prof. Atis Dasgupta receiving Shri Buddhadeb Bhattacharya, Chief Minister of West Bengal at inaugural function of International Conference on Pattern Recognition and Machine Intelligence, at ISI on 18th December, 2005



Prof. Jayanta Kumar Ghosh, former Director of ISI and President of International Statistical Institute speaking at the U.G.C. Refreshers' Course in Statistics held in I.S.I., Kolkata, February 2006

Prof. L. A. Zadeh in ISI with Professor D. Dutta Majumdar and Professor Sankar K. Pal, Director, February 2006

Prof. L. A. Zadeh is warmly flanked by Prof. M. G. K. Menon and Prof. Shankar K. Pal at Amrapali, 17th Feb., 2006

Prof. M. G. K. Menon, President of I.S.I. conferring honorary D. Sc. degree on Prof. L. A. Zadeh during the 40th Convocation of I.S.I. on 17th February, 2006; Prof. Sankar K. Pal, Director, is on the dias

Professor L. A. Zadeh, along with Prof. Sankar K. Pal, Prof. D. Datta Mazumder, Prof. Malay K. Kundu and Prof. Dilip Saha, in front of the mounted skeleton of Barapasaurus tagorei, the oldest sauropod dinosaur Feb. 2006

Prof. S. K. Pal, Director and Prof. Atis Dasgupta speaking to Prof. Ramkrishna Mukherjee at Geology Auditorium on the occasion of birthday celebration of Prof. P. C. Mahalanobis on 29th June, 2006. Sitting beside him is Prof. Deb Kumar Bose

Prof. Sankar K. Pal, Director, Indian Statistical Institute, planting a sapling at Bangalore Centre on 5th Sept. 2006

Prof. Sankar K. Pal is welcoming Prof. R. Penrose, the eminent Mathematical Physicist in I.S.I., 17th November, 2006

INDIAN STATISTICAL INSTITUTE
FOUNDATION DAY CEREMONY IN THE PLATINUM JUBILEE YEAR
17th DECEMBER, 2006

Prof. Sankar K. Pal, Director, lighting the lamp on the occasion of the Foundation Day (17th December, 2006) of the Institute in the Platinum Jubilee Year. Prof. Nikhilesh Bhattacharya, Prof. D. Datta Majumdar, Shri Prabir Das, Prof. Deb Kumar Bose and Prof. Atis Dasgupta were also present in front of the photograph of Professor P. C. Mahalanobis in the Geology Auditorium.

Illumination of R. A. Fisher Bhavan (formerly RTS building) on the eve of Platinum Jubilee celebration of the Institute

Statistics is the universal tool of inductive inferance, research in natural and social sciences, and technological applications.

Statistics, therefore, must always have purpose, either in the pursuit of knowledge or in promotion of human welfare.

P. C. Mahalanobis